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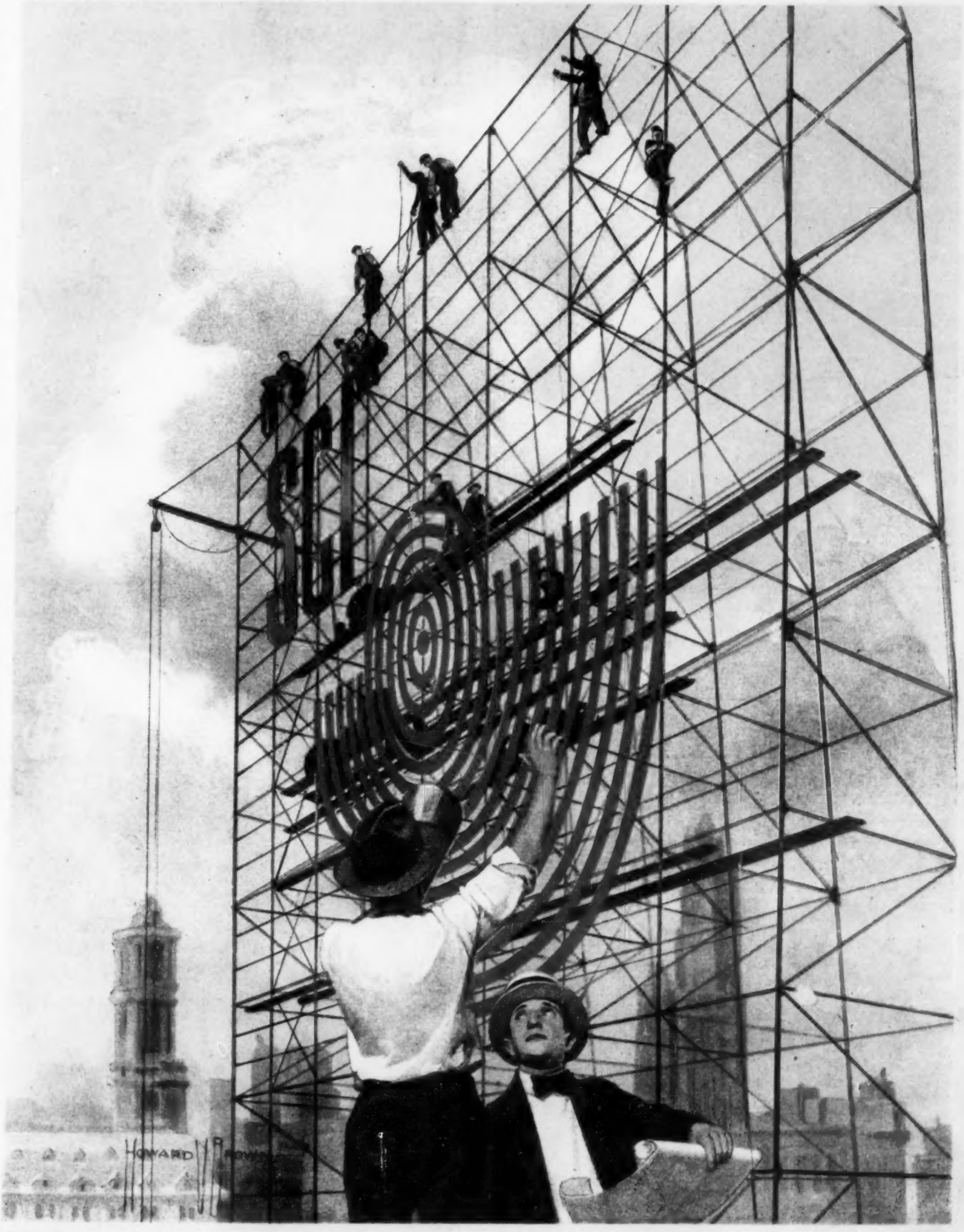
INDUSTRIAL ALCOHOL
THE MOTOR CLIPPER

SCIENTIFIC AMERICAN

A Weekly Review of Progress in

INDUSTRY · SCIENCE · INVENTION · MECHANICS



ERECTING ONE OF NEW YORK'S HUGE ELECTRIC SIGNS

Vol. CXXV. No. 10
September 3, 1921

Published Weekly by
Scientific American Publishing Co.
Munn & Co., New York, N. Y.

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20 cents in Canada

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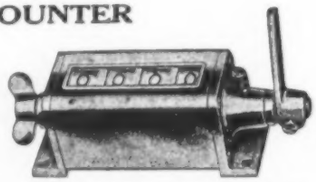
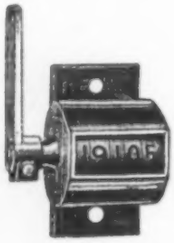
Veeder
COUNTER

The large Set-Back Revolution Counter at right is less than ½ actual size. The small Revolution Counter below is shown nearly full size.





The Set-Back Revolution Counter above records the output of the larger machines where the revolution of a shaft registers an operation. Counts one for each revolution, and sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, according to purpose. Price, with four figures, as illustrated, $10.00 (subject to discount).

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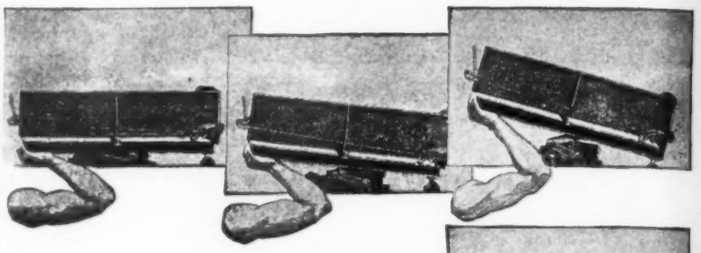

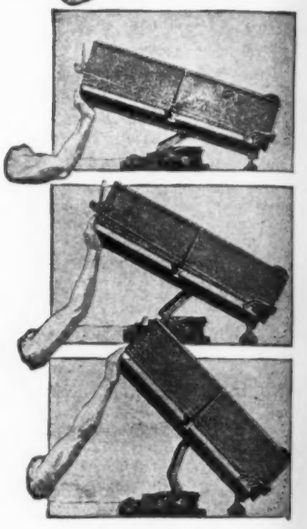

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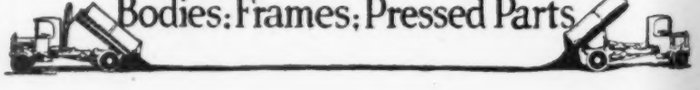
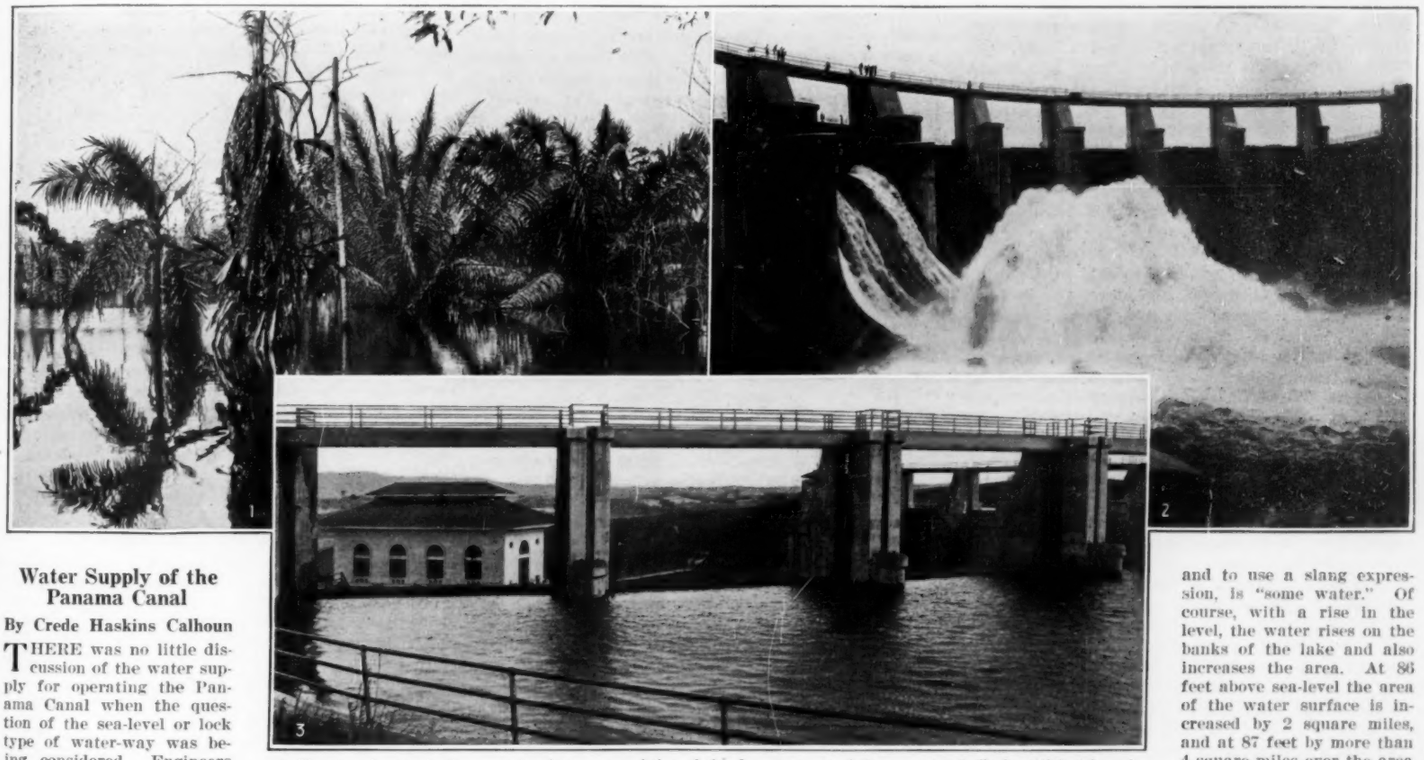


SEVENTY-SEVENTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXXV. NUMBER 10] NEW YORK, SEPTEMBER 3, 1921 [15 CENTS A COPY 20 CENTS IN CANADA



1. The rise of water in the green jungle upon completion of the dam was one of the most tragically beautiful sights of nature ever witnessed. The dying jungle is seen in this view, when the surface of water was 52½ feet above mean sea level. 2. When there is a surplus of water during the wet season it is wasted over the spillways in the Gatun Dam. 3. Looking towards the Atlantic from the spillway, with the hydroelectric plant in the foreground and the Chagres River 85 feet below

Some features of the water supply for the Panama Canal

Water Supply of the Panama Canal

By Crede Haskins Calhoun

THERE was no little discussion of the water supply for operating the Panama Canal when the question of the sea-level or lock type of water-way was being considered. Engineers favoring the sea-level canal were of the opinion that there would not be sufficient water to operate the lock type, the greater part of which was to be 85 feet above sea-level. After consultation with some of the most eminent engineers in the world, President Roosevelt took the responsibility for deciding in favor of a minority report recommending the lock type.

The water for lockages and floating vessels at the 85-foot level, from Pedro Miguel to Gatun, a distance of 28.52 nautical miles, in the present canal, was obtained by building a dam across the Chagres River at Gatun and then blocking the Gaillard Cut (formerly Culebra) by the locks at Pedro Miguel. This has created an artificial lake with an average area of 165 square miles, extending from Gamboa to Gatun and reaching with its octupus-like arms far inland through the jungles. Only a portion of this lake area in the vicinity of Gatun locks was cleared before flooding and in the rest of the area the jungle was literally drowned. The gradual rise of this water in the green jungle upon completion of the dam was one of the most tragically beautiful sights of nature ever witnessed, though behind it all was the hand of man. Now the lake presents a spectacle of sun-bleached skeletons of trees, once as gloriously beautiful as only trees, and tropical trees, can be, bearing occasional bunches of orchids like funeral offerings of nature.

Experience has shown that so far there has been sufficient water for operating the canal, though during the last dry season the lake was at the lowest level in history, due to the number of lockages and the fact that it was one of the longest dry seasons in a good many years. The dry season in Panama usually lasts about four months and during the rest of the year the almost constant rains tend to keep the lake at a high level and furnish more water than is needed. The rainfall at the canal averages 129 inches a year at Colon and 69 at Panama, while the average is probably considerably higher at the headwaters of the Chagres River.

As a result of the low level last dry season, in preparation for the present season, which began in mid-December, 1920, the operation of the spillway of Gatun Lake (the spillway is a series of gates in the dam that lets out surplus water) was regulated in the early part of December to bring the surface of the water to the maximum storage height, 87 feet above mean sea-level. This point was reached on December 7th, and was maintained until December 23rd, when a dry period lowered the water to 86.90 feet. A rain on the 28th brought it up again to 87, but since that time it has dropped about half a foot below that point. The level of the lake cannot be raised above 87 feet, because above that point the withdrawal of water from Gaillard Cut for a lockage would create a surge, a miniature tidal wave, that would flood the operating machinery of the Pedro Miguel locks.

The area of Gatun Lake at its normal elevation of 85 feet above sea-level, which is 2 feet below the storage maximum, is 163.4 square miles. A foot of water spread over that area runs into billions of cubic feet, and to use a slang expression, is "some water." Of course, with a rise in the level, the water rises on the banks of the lake and also increases the area. At 86 feet above sea-level the area of the water surface is increased by 2 square miles, and at 87 feet by more than 4 square miles over the area at the 85-foot level.

The quantity of water necessary to raise the surface of the lake from the 85- to the 86-foot level is 4.60 billion cubic feet (you have to stop and say that number over to yourself to appreciate it), and the quantity required to raise it from the 86- to the 87-foot level is 4.65 billion cubic feet. So it can be seen that the raise of two feet in the level of the lake provides a storage of almost ten billion cubic feet of water.

Of course the lake loses much water through evaporation during the dry season as the tropic sun is very hot, and that is about equal to the run-off from the watershed of the lake as the result of occasional rains during the dry season. The total loss through evaporation during the calendar year 1920 was 22.40 billion cubic feet representing about 13 per cent of the inflow. The principal source of supply for the lake is the Chagres River, a long, and, during the wet or rainy season, mighty river, fed by many tributaries that collect water from the mountain valleys over an area of hundreds of square miles. The rainy season lasts eight months and people who have not seen a tropical rain have only experienced gentle showers by comparison. During this time there is a surplus of water in the lake which is wasted over the spillways. This amounted to 87 billion cubic feet or 47 per cent of the inflow during the calendar year 1920.

Only 10 per cent of the water used from the lake during the calendar year 1920 was on account of lockages in lifting vessels to and lowering them from the 85-foot level of the main part of the canal. It is esti-

(Continued on page 171)

THE SCIENTIFIC AMERICAN, September 3, 1921. Volume 125, Number 10. Published weekly by Scientific American Publishing Company at 233 Broadway, New York, N. Y. Subscription price, $6.00 per year. Entered as second-class matter June 18, 1879, at the post office at New York, N. Y., under the act of March 3, 1879.

SCIENTIFIC AMERICAN

Published by Scientific American Publishing Co.
Founded 1845
New York, Saturday, September 3, 1921
Munn & Co., 233 Broadway, New York

Charles Allen Munn, President; Orson D. Munn, Treasurer
Allan C. Hoffman, Secretary; all at 233 Broadway

Entered at the Post Office of New York, N. Y., as Second Class matter. Trade Mark Registered in the United States Patent Office.

The Loss of "ZR-2"

NO element of tragedy is wanting to render the loss of the "ZR-2" one of the most lamentable disasters in naval and military history. This huge ship, the largest and fastest of its kind, was approaching its landing place after a most successful and extended flight, lasting for a day and a half, when, without warning, she broke in two, burst into flames, and with terrific explosions fell into the River Humber. This meant the failure and complete loss of a dirigible which was believed to embody the ripest experience of the masters of aeronautical design, and which had been built at a cost probably exceeding two million dollars. That in itself was bad enough; but a far greater tragedy is the fact that in this disaster there died the very flower of the dirigible experts of the United States and Great Britain. The death roll includes the names of Brigadier General E. M. Maitland, Chief of the Royal British Air Force, and of Commander Louis H. Maxfield, the ablest officer in the lighter-than-air forces of the United States Navy. In addition to these is a pitifully long list of United States and British officers, all of them expert in their special fields, and a large force of non-commissioned officers and enlisted men. At the present writing the exact number of fatalities is not known; but since not over half a dozen seem to have escaped death, it is possible that the final list will include over forty officers and men.

The "ZR-2" left the Howden base at 7:10 A. M. on August 23rd for an extended trial trip which was to be completed by a run at full power at a speed of 75 miles an hour. This was her fourth flight. At 8 P. M. she signaled that she would stay out all night, and another message was received at 7 A. M. on August 24th that she would continue to cruise throughout the day. At 4:30 on the evening of the 24th she sent word that she was about to carry out her full speed trials, and her last message came in at 5:34, when she stated that she would make a landing at Howden at 6:30.

At 6:30 P. M., when the great ship was passing at a moderate elevation over the city of Hull, she was seen gradually to buckle at the center and then break in two. This was followed by fire and a series of explosions, which were sufficiently powerful to break the windows in the city below. Fortunately for the inhabitants, the commander of the ship is reported to have swung her out toward the harbor and she fell in the river not far from the Hull docks.

A strong presumption as to the cause of the disaster is afforded by the preliminary trials of the ship, in which she seemed to develop a lack of sufficient girder strength, certain parts of her frame showing signs of buckling. An attempt was made to remedy this by the introduction of additional stiffening material. In the absence of any exact data, it is impossible to make any definite statement as to the cause of her loss; but it certainly does look as though, in the effort to secure great cruising radius and the abnormally high maximum speed of 75 miles an hour, the framing of "ZR-2" had been cut down perilously close to the margin of safety, whatever that may have been.

A suggestion as to the immediate cause of the disaster is found in the testimony of witnesses that just before it occurred, she made a rapid change of course. This would throw a heavy pressure on the rudders which in turn, because of the inertia of the concentrated weights, would bring a heavy bending moment to bear upon the fragile structure of the whole. A sudden local puff of wind, inopportunely striking the rudders at this moment, would increase the effect, and the combined result may have been too much for the girder strength of the ship.

Uncharted Perils of the Road

VARIOUS sections of the country have experienced, during the recent intense July heat, a phenomenon usually referred to as the "blowing out" of the road. This occurs only on hard surfaced highways, and is usually confined to those of concrete, brick or blocks. The cause, of course, is found in insufficient allowance for expansion in laying the pavement. Most of us have passed places where the road was thus upheaved, or have even encountered a road made almost impassable by such occurrence. But a new angle is given by a Connecticut paper that tells how the road "blew up" under a passing car, and actually hurled the occupants a considerable distance. The idea of having the road explode beneath one is startling, to say the least.

An exploding road is not the only thing that may embarrass the midsummer tourist and lead him into a detour, however. The morning papers recently told a curious tale under a Kentucky date line. A hollow tree along the roadside near Lexington had been inhabited for many years by a large colony of bees. A big storm blew it down across the road, and scattered honey all over the neighborhood. The bees refused to abandon their property, and hovered in great numbers over the scene of the tragedy. Everyone who attempted to approach the spot was speedily put to rout by the angry insects, who at last accounts still held the fort, while all traffic was being detoured.

At the time when this curious item came to our attention we had just had an illuminating experience of our own. Everybody knows that a freshly oiled road is slippery and skiddy. Does everybody know that, given enough oil, it becomes absolutely impassable? On a certain 200-yard section of winding, sharply-crowned road the enterprising foreman laid enough oil for about two miles of roadway. The result was a blockade that lasted all the afternoon, and several very close shaves that failed of being wrecks only by a miracle. The road surface was so slippery that it was literally impossible to walk on it, let alone drive a car. We know this, because we tried it, and skidded expeditiously into the ditch.

Some weeks ago we made still another surprising discovery, which still has us chuckling. In tracing the route from town to town and from fork to fork between two termini, as given by the road book, we encountered the following charming entry: "18.5 miles. Caution for deep ford. Cross well up at a slight angle, go around the big snag to the left, and turn sharply to the right just before reaching the far bank." And again, a few miles farther on: "Caution for *very* deep ford. Best crossing is found by going upstream to the footlog, and crossing directly below this." This we must confess is one of the perils of motoring that had not been brought to our attention by our experience in the effete east. When one makes a misstep in one of these deep fords, and goes in above the level of carbureter or distributer, we wonder what the next move is? Does one of the party go swimming after a farmer with a horse, or is the first passing motorist supposed to do the rescue act?

There is something else that, sooner or later, happens to every driver of a car with gravity fuel-feed. The manufacturers of these cars tell you never to let the fuel get very low. They do not tell why, and most purchasers, being better posted than the short-story writer who represented a green driver as being able to stop without serious difficulty *because the gas was low*, are inclined to laugh at the warning. If one of these cars ever goes dead under you while running up a hill, you may be in a position to learn why five gallons of gas in the tank are better than a gallon and a half. Under such circumstances, before fussing with the ignition system or worrying about the condition of feed-line or carbureter, permit the chariot to roll down to the first level spot, and see whether the trouble was not due to low gas. The possibility of getting on a hill where the carbureter intake enjoys a greater elevation above sea level than the surface of the fluid in the tank will be better realized when it is stated that, so far as power alone is concerned, the "well-known American small car" will run up a hill so steep that the tank must contain more than six gallons of gas in order to get any flow to the carbureter.

When the gas station is at the bottom of the hill, of course, one simply slides down to it. When it is at the top the remedy is equally simple though perhaps not so obvious. Turn the car around, by man-power if necessary, and back *up* the hill to the pump.

The Backbone of the Fleet

THE report rendered by the Joint Army and Navy Board on the recent aerial bombing tests off the Virginia Capes confirms the lessons which we drew in our issue of August 6th from these trials. The findings of the report are summed up in the following statement: "The battleship is still the backbone of the fleet and the bulwark of the nation's sea defense, and will so remain so long as the safe navigation of the seas for purposes of trade or transportation is vital to success in war."

The above quotation is one of the ten conclusions, categorically stated, in which the Joint Board, made up of naval and army officers, submitted its findings on the burning issue as to whether bombing aircraft have rendered the battleship obsolete. The argument runs as follows: That if the Navy commands the sea routes, the lines of traffic can be kept open without entering the area on the enemy's coast zone which is controlled by aircraft bases on shore. Conversely, a nation without an effective navy must submit to a fatal economic blockade. Again, if heavier-than-air craft are to be effective in naval warfare, they must be able to operate in midocean; and since their own radius of action is limited, they must operate from those mobile bases known as aircraft carriers. Although our Navy does not know of any case in which bombing planes, such as sank the "Ostfriesland," have flown from or landed on an aircraft carrier, it is believed that such operations will in the future become practicable. In this connection, the report quotes the "Argus," of the British Navy, as a type essential to the highest efficiency of the fleet; but the point is made that since aircraft carriers are subject to attack by vessels armed with guns, torpedoes or bombs, they, like all other subsidiary types of vessels, will require the eventual support of the battleship.

We think this last statement is subject to criticism. A 30,000-ton, 32-knot aircraft carrier would be self-supporting; and for defense against a too-powerful enemy would depend upon her superior speed to enable her to keep out of range. The best of modern battleships cannot hit beyond 20 or 25 miles—an aircraft carrier could maintain a range of 30 miles and send out her bombing planes against the enemy with complete immunity to herself.

The report admits that although the airplane, like the submarine, destroyer, and mine, has added to the dangers to which battleships are exposed, it has not made the battleship obsolete, although the appearance of aircraft has added to the existing complexity of naval warfare.

With the final clause of the report, as indeed with the whole report as such, we are in thorough accord. It states that the aviation and ordnance experiments, conducted with the ex-German vessels as targets, have proved that it has become imperative as a matter of national defense to provide for the maximum possible development of aviation both in the Army and Navy. These bombing experiments have also proved the necessity for aircraft carriers of maximum size and speed as an effective adjunct of the fleet. It is likewise essential that effective anti-aircraft armament be developed.

Now there is danger, we think, of becoming so greatly impressed with the necessity for building an effective fleet of aerial bombing planes as to overlook the equally important defensive side of the problem. The present popgun arrangements, mounted on warships for the purpose of bringing down airplanes are futile. Shells thrown by 3- and 4-inch gun do not afford a big enough burst and spread; moreover, there remains to be developed an accurate and swift means for determining the ever-changing position of the enemy. We look to see the day when the 5-inch anti-torpedo batteries of warships will be known as anti-torpedo and anti-plane batteries; which means that they will be mounted on the topmost decks and provided with unlimited elevation.

Electricity

Hydro-Electric Developments, totalling 13,500,000 horsepower, and a doubling of the present ratings of central station plants, are regarded as probable within the next four years by some American authorities. It goes without saying that vast quantities of copper are to be used, for until now there is not a real substitute for this metal. Aluminum is an excellent alternative, but copper remains the best conductor material.

Radio Service Between London and Paris. — From the French journal *Radioelectricité*, we learn that stations for regular communication between these two cities are located in Neuilly-Levallois, France, and Chelmsford, England. A high-frequency generator of 10 to 25 kilowatts is employed for sending. Signals are first recorded by perforation by means of a special machine upon a strip of paper and are then sent at about a hundred words per minute. The received messages are considerably amplified and are registered upon a fast rotating wax disk similar to that of a phonograph. For transcribing, the disk is revolved much more slowly, to enable the operator to copy the message on a typewriter.

Radio Aboard Airplane.—In a recent issue of *Radioelectricité* there are described the various stages of the development of radio communication from and between airplanes. The first satisfactory operating set in French aviation contained a spark coil fed from a 20-volt storage battery. Later the heavy storage battery was superseded by a small air-screw-driven generator running at an average speed of 4500 r.p.m., and delivering 20 volts at 5 amperes. Finally, two types of air-screw-driven 900-cycle alternators were developed, differing only in weight and bulk from each other. Both are rated at 50 volts and 7 amperes at 4500 r.p.m. The machines contain a direct-connected exciter and a tooth-wheeled generator with no rotating windings. A rotary spark gap mounted on the main generator shaft is used on both types.

Electric Cooking Simplified.—Everyone is ready to admit the superiority of the electric stove over all other types. It is clean, efficient, cool in summer, and certainly scientific. But it is expensive to run in most localities where current costs upwards of 10 cents per kilowatt hour, and therein lies its greatest drawback. Now an American manufacturer has come forward with a remarkably economical electrical range. It comprises an aluminum-lined electric fireless cooker, fully equipped to steam, stew and broil foods. Needless to say, the minimum of current is required for this device. An aluminum-lined electric oven is also included, fully equipped to bake, roast, broil and toast perfectly with two 660-watt units. Then it also has a solid cast aluminum frying skillet, with self-contained nickel chromium heating element, which gives instant heat for frying.

The Department of Commerce has recently announced the appointment of R. A. Lundquist, of Minneapolis, Minn., as head of the newly created Electrical Machinery Division in the Bureau of Foreign and Domestic Commerce. This is one of the new industrial divisions made possible by Congress through the export industries act. It is planned to secure the services of experts to specialize on the more important export commodities. Mr. Lundquist, who is a graduate of the University of Minnesota, is an electrical engineer of wide experience. He has made extensive studies of possibilities for the sale of American electrical goods and machinery in Australia, New Zealand, China, Japan, and South Africa, the results of which were published by the Bureau of Foreign and Domestic Commerce, and is the author of "Transmission Line Construction Methods and Cost," and various articles for technical and engineering journals.

Pacific Coast Inter-City Radio.—The Federal Telegraph Company, so we learn from *Electrical Review*, has about completed the construction and equipment of radio stations at San Francisco, Los Angeles, and San Diego, Cal., and at Hillsboro, Ore., for inter-city communication. The San Francisco and Hillsboro stations, which are identical as to design and capacity, have a transmitting range of 5000 to 7000 miles under favorable conditions, and the equipment is similar to that of the Lafayette station at Bordeaux, France. The tower at the Hillsboro station has a height of 626 feet and a horizontal cross-section of 6 by 6 feet. The columns comprising this tower are supported in vertical position by five sets of guy cables, having four guys to each set with each guy anchored to a reinforced concrete pier. Four arc converters are employed in each station, one being of 60-kilowatt capacity, the other three being of 30-kilowatt capacity. The stations are equipped with quadruplex transmission, giving a speed on any one circuit of about 150 words per minute.

Science

No Tree Signs for the Navy.—The efforts of the National Highways Protective Society has resulted in orders from the Navy Department that the recruiting service at once cease to use growing trees as billboards for recruiting signs.

Accidents in the Alps.—The abnormal heat in Switzerland has given an impetus to mountain climbing; in consequence, an appalling number of accidents is reported. Climbers usually fall into ice crevasses or are struck by falling stones.

Sir Richard Burton. — In celebration of the hundredth birthday of this intrepid explorer, whose adventures read like his own translation of the Arabian Nights, the Royal Asiatic Society will institute an annual memorial lecture and strike a medal bearing Burton's effigy.

Archaeology on the March. — In their progress through Asia Minor, Greek troops discovered in an old cemetery near Kutaia columns of blue marble formerly part of a great building of the Roman period. Many inscribed tablets were also picked up on the march.

Explorers Disagree.—Stefansson says he will take along no food on his mush to the Pole, while his rival Amundsen has just contracted for a seven-years' supply. Amundsen says there is little animal life north of 85 degrees, and the sleds must be loaded with food if the explorer would not face starvation.

Eustachio's Manuscripts. — Bartolomeo Eustachio, whose name is perpetuated in the term "Eustachian tube," was an Italian physician to whom Pope Pius IV. gave permission to dissect human bodies in the furtherance of anatomical knowledge. The original manuscripts of his works have just been unearthed.

Rotation of Venus. — Observations of certain dark spots on Venus by Prof. W. H. Pickering appear to indicate a rotation period of 68 hours. He states that the motion of the spots was not from west to east but from north to south, implying that the axis of the planet lies very nearly in the plane of its orbit.

Varro's Aviary.—Varro, author of a famous book on agriculture, lived in the Ciceronian age. He built a model aviary, with fish ponds, and duck houses enclosed by fine gut nettings. Similar netted spaces housed blackbirds, nightingales and other song birds. A little channel furnished fresh water, and food was introduced beneath the nets.

An International Hydrographic Bureau, with Great Britain, the Netherlands and Norway represented in the directorship, has been established. Headquarters will be at Monaco, where it will doubtless have the cooperation of that eminent oceanographer, the Prince of Monaco. The United States has announced its intention of becoming a member.

Field Work of the Smithsonian Institution.—In 1920 this institution undertook 23 separate expeditions in various branches of science. The work in the Canadian Rockies was eminently successful. New astrophysical stations were established in Arizona and in Chile, and from these may be definitely determined the value of the solar constant in weather forecasting. The African expedition yielded a wealth of zoological material, and from Australia came rare specimens of the fast-disappearing fauna. On Mt. Wilson, Cal., a device was used that by the sun's heat alone cooked bread, meat, vegetables and preserves.

Proposed Reform of Our Calendar. — Prof. René Baire, of Dijon, has a most revolutionary plan for calendar reform. He would shorten most of the weeks to six days, give us a Saturday but once a month, take one day from January and, except in leap year, from July, and give February thirty days. The 1st, 7th, 13th, 19th and 25th days of each month would be Sundays—sixty to the year, and New Year's day and Christmas would always fall on Sunday. This sidetracks the objections to placing certain days in each year outside the weekly and monthly reckoning. It is doubtful, however, if the public would ever cheerfully accept this reparceling of its time.

Confirmation of Pickering's Lunar Observations. — Prof. W. H. Pickering's numerous accounts of rapid changes on the moon's surface, attributed to snow, vapors, etc., have been received with a good deal of skepticism by astronomers in general. He has now acquired a champion, in the person of Sir W. H. M. Christie, who visited him at Mandeville, Jamaica, last February and made observations of the moon with the Draper 11-inch refractor. The British astronomer reports in *Monthly Notices* R.A.S. that, in spite of unfavorable weather, he observed remarkable changes in the craters Aristillus and Eratosthenes and also in the Bradley "Snow Field." The changes are fully described and illustrated with drawings.

Aeronautics

A Height Record.—From France comes word that Georges Kirsch created a new height record recently, when, on a "Nieuport," equipped with a 300-horsepower Hispano-Suiza engine, he reached an altitude of 9800 meters (32,153 feet), thus beating the previous record held by Casale of 31,216 feet.

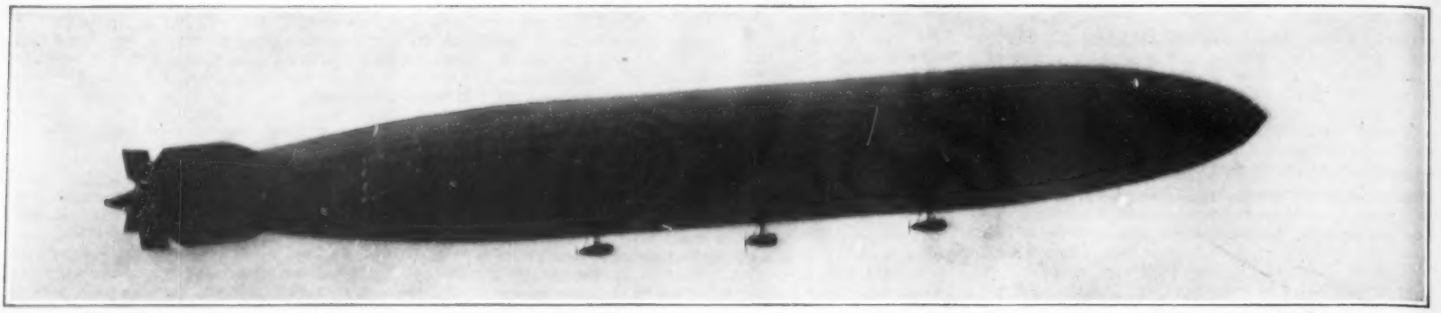
Paris Aeronautical Exposition.—The Seventh International Aeronautical Exposition will be held at Paris on November 12 to 27, 1921, according to a recent communication. Exhibitors are welcome from any country not having been at war with France. This exposition is not confined to flying machines and motors, but will include sections devoted to aerial navigation companies, motor boats, gliders, machine tools, marine motors, electrical apparatus, spare parts, and industrial materials relating to the aeronautic industry.

An Ambitious Project.—It is reported that there is in process of formation an all-British aerial transport company, which proposes to run regular services of airplanes and airships—the former daily to Paris, Brussels, and Amsterdam, and the latter twice weekly to America and Canada. The airplanes will be built entirely of metal and so designed that in case of a forced landing in the sea they will float and the passengers will not get wet. Parachutes will be fitted to the aircraft. The airships are intended to do the journey to New York in 48 hours. They will carry 50 passengers and will contain sleeping cabins, dining and smoking rooms, and a lounge, while the catering will be in charge of a chef. The crew will number 15. The inclusive fare to New York will be about $250, which is approximately the present steamship first-class fare.

Improved Airplane Propeller. — Announcement is made in the *Times* of the invention of an improved type of airplane propeller whereby engine power necessary for driving the the airplane will be lessened and the vibration of the machine will be much reduced. The new type of propeller arises from the addition of a number of "veins" or flanges made of aluminum to the existing type of propeller. These "veins" are about 6 inches in height and run parallel across the surface of the propeller at a distance of about 1 foot from each other. There are eight at the drive side, four at each end of the blade, and six on the wind side in similar positions. It is claimed that by this arrangement the air is properly directed past the propeller blade faces, with the result that there is an avoidance of the air losses from the blade ends, which through natural causes take place in the present type of propeller, making possible a maximum thrust with a minimum expenditure of power.

A Pumping Plant for the Airplane.—Herr Fokker's excellent airplanes are too well known to require elaboration here. However, we note in looking over the plans of his latest creation, the "Fokker F-III," a passenger-carrying monoplane, that he has made use of a tiny power-driven pump which serves to transfer gasoline from the usual supply drums to the airplane tanks. The pump is mounted near the port side of the engine housing. From this pump a length of rubber tubing, normally coiled up inside the engine housing, can be taken outside the machine and its free end inserted in a gasoline can or drum. A few strokes of the pump soon transfers the gasoline to the airplane tank, and the pump is ready for the next can or drum, and so on. The entire operation of filling the airplane's tanks—and airplanes of such proportions seem to have an insatiable appetite for fuel—can be accomplished by one man in a few minutes, and there is no slopping over and spilling the gasoline all over the machine.

Three New Fog Devices to overcome the drawbacks of mist and fogs to airmen are stated to be under discussion by British authorities. The first consists of the "laying along the route traversed by the airway of a powerfully charged electrical cable. This automatically sends up into the air a constant series of signals." By keeping his machine in such a position that the strength of the signals is kept constant the airman is assured that he is flying along the cable line. The second makes for safety in landing when the ground is not visible, and consists of a wire, with a weight attached, which is lowered from beneath the machine; when the weight touches the earth the airman learns that it is time to "flatten out" his machine. The third is called the "artificial horizon." It is "a gyroscopic instrument which shows an artificial horizon line always in front of the pilot and enables him to detect instantly when his machine is heeling over too much sidewise in its relation to the real horizon, which is temporarily invisible. A tiny model airplane poised above the artificial horizon line mimics precisely the movements of his own machine."



The "ZR-2" in flight. This British-built dirigible, purchased for the use of our Navy, measures 700 feet long and has a cruising range of 9000 miles

Our "ZR-2" Airship and Its Shed

Some Details of the Giant Dirigible and the Huge Hangar To Be Used by the U. S. Navy

By George H. Dacy

A HUGE work of aerial construction with a capacity of 2,720,000 cubic feet, with a total length of 700 feet and 85 feet wide with a gross lift of 84 tons and an available life of approximately 45 tons, which consists of gasoline, oil, crew, cargo and armament, with a full speed velocity of 75 miles an hour and a cruising speed average of 50 miles an hour, with commodious and comfortable accommodations for a crew of 42 men and officers, the "ZR-2," the largest airship ever built, at this writing is about to undertake a record-breaking trip from Howden, England, to Lakehurst, N. J.

In July, 1919, the British airship, "R-34," made the trip from East Fortune, Scotland, to Hazelhurst Field, L. I., in 108 hours and 12 minutes.

The "ZR-2" was built at the Royal Airship Works, Cardington, Bedford, England. It is to be piloted to the United States under the guidance of Commander L. H. Maxfield, U.S.N., with a crew of 30 men and 12 officers of the U.S.N.

The gigantic dirigible which Uncle Sam purchased from England is so huge that if it were placed in Times Square, New York City, there would only be enough space left to walk around the enormous mechanical bird. The Capitol Building at Washington, D. C., is only 25 feet longer than the "ZR-2," while if the ship could be stood on end beside the Washington Monument, her tail would tower 150 feet above that memorial skyscraper. The top of the Woolworth Building in New York City is only 92 feet higher than the peak point which the airship could reach in this position.

The motive power of the mammoth aerial flier consists of six 350-horsepower (Sunbeam Cossack) motors located in six power cars. She carries 10,400 gallons of gasoline, which gives her a cruising radius of 6000 miles at full speed or about 9000 miles at cruising speed. The propellers on two of the power cars are equipped with reversing gear, which enables the ship to check her speed at will or even to fly astern. The dirigible is controlled from a special control car situated forward, which is similar to the bridge of a ship. It permits the commander to handle this airship exactly as does the captain of a sea-going vessel. A complete communication system, consisting of telegraphs, ship telephones and voice tubes, expedites the transmission of orders. All orders to the power units sent out over the engine telegraphs are repeated back to the control car before being put into execution. The "ZR-2" is also equipped with a radio set that has a sending radius of about 1500 miles, and it is also provided with a wireless telephone and a radio direction finding set.

The "ZR-2" is about 500,000 cubic feet larger than the huge German Zeppelin "L-71," which the Huns built to bomb New York City, and which was surrendered to Great Britain under the terms of the Peace Treaty. The "ZR-2" was designed expressly for naval purposes, and paramount importance has been accorded those facilities which admit of the attainment of maximum altitude. The construction of this ship marks a very definite advance in airship practice, as it is the pioneer ship of purely new design and arrangement and not merely a copy of previous German ships. In general principles, the hull structure is of standard type such as was used in the Zeppelin airships, but a very considerable saving of structural weight has been effected by a large number of improvements in detail. It is built of duralumin, and consists of a number of longitudinal, lattice girders connected transversely by other lattice girders which form a series of rings, the longitudinals and rings being braced by wires. This structure contains 14 compartments in each of which is a gas bag made of fabric and goldbeater's skin. Goldbeater's skins are obtained from the outer coverings of the intestines of a cow. Only one goldbeater's skin results from each cow that is slaughtered and it would consume all the cattle on several of our largest western ranches to provide the 60,000 skins necessary to line the hydrogen gas bags of the "ZR-2."

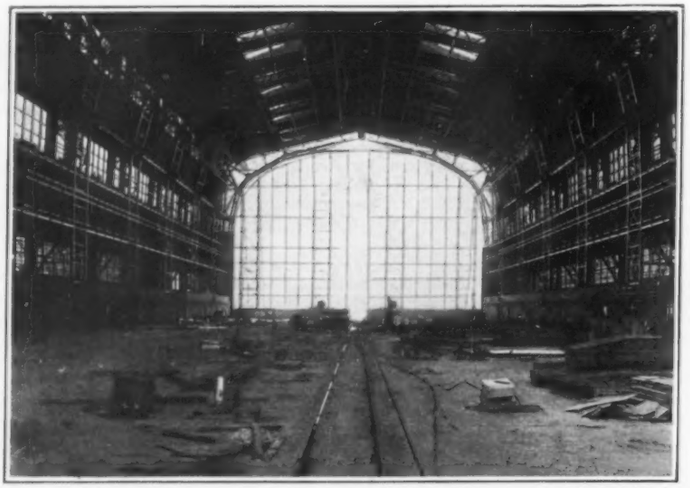
AS we go to press, cable dispatches tell of the tragic loss of "ZR-2" with the majority of her American crew. Comment upon the disaster will be found in our editorial columns.—THE EDITOR.

If the outer cover of the "ZR-2" were spread on the ground it would cover an area of more than 4 acres. If all the piano wire used in this Goliath of airships were placed end to end, it would reach over 60 miles. This wire is used as stays and braces, the structural strength of the ship being largely dependent on this reinforcement. There are also over 20 miles of duralumin channel sections used in making the girders in the hull of this novel air boat. Inside the bottom of the airship and running from end to end, is a corridor containing the aluminum petrol tanks, the fabric water ballast bags, accommodations for bombs for wartime uses, and the sleeping and living quarters of the crew. This keelway is 8 feet wide and 7 feet high. The quarters are furnished with comfortable bunks, benches, chairs, tables and several talking machines. Each power car is equipped with a special cooking arrangement which admits of the expeditious preparation of meals by the utilization of the hot exhaust flames from the motor as sources of heat.

The largest airship hangar in the world has been built at the Naval Air Station, Lakehurst, N. J., where the "ZR-2" is to be housed and where, potentially, our Navy intends to construct the first rigid airship in this country. The inside, clear dimensions of this mighty garage for air-going craft are: width, 258 feet; length, 803 feet; and height, 172 feet. The building has the largest clear roof area of any structure ever built in this country, and to obtain this enormous roof surface, the overall dimensions of the hangar are: width, 350 feet; length, 943 feet; and height, 200 feet. The entire Capitol Building at Washington could be placed inside the hangar and even then there would still be plenty of room. The inside volume of the structure is seven times larger than that of the Woolworth Building. If the hangar were flooded with water, two of our largest battleships could sail through it side by side.

The building is constructed of three hinged steel arches and towers, large, self-supporting steel doors being placed at both ends. Each door is 177 feet high, 136 feet long and 77 feet deep and is composed of two self-supporting leaves operated by electricity and rolling out on steel tracks set in concrete. The steel used in this mammoth building weighs more than 8000 tons; the corrugated asbestos siding used would cover 4½ acres and the steel sash more than 2 acres of ground area. Railroad tracks and docking rails extend the entire length of the hangar. The building is equipped with elevators, stairways, offices, shops, storerooms and a cafeteria, all of which are located outside the clear floor area in the space available at the foot of the towers. The hangar cost approximately $3,000,000. A large power plant for furnishing electricity for operating the doors and lighting the hangar and other buildings and for furnishing steam for heating the hangar, has been built and equipped, as well as barracks and mess halls for 500 men. A large hydrogen plant capable of producing 60,000 cubic feet of hydrogen daily has been built, as well as a gas holder of 1,000,000 cubic feet capacity. A large landing field of 1400 acres has been cleared and graded to permit of the safe landing and handling of the airships.

An interesting feature of the hangar are the docking rails which run through the hangar and cover a distance of more than 1500 feet beyond each end of the building. In effect, they are conduits with narrow slots through which lines reaching from a trolley inside the conduit can be extended to the airship being launched or docked, and are similar in general detail to the ordinary trolley or conduit construction with slots, except that provision had to be made for the uplift of the airship. A trolley of special design is provided which, when not in use, rolls along the bottom track in the conduit but, when in use for docking or launching, rolls on its upper bearing on the under side of the slot rail.



One end of the interior of a huge airship hangar constructed at Lakehurst, N. J., for the "ZR-2"

(*Continued on page 171*)

Utilizing Tomato Waste

FIGURATIVELY speaking, the glass jar and the tin can are the backstops to America's prodigality in seasons of luxurious plenitude. And yet the waste from commercial canneries and home canning outfits is appalling—the discarded refuse taking the form of trimmings, skin and seed. The utilization of tomato pulp exclusively in the manufacture of catsups and soups renders useless the seeds and skins unless they are recovered as commercial by-products.

The business of converting tomatoes into table products, such as soups and catsups, is one of magnitude in the United States, 120,000 tons of tomatoes being pulped annually in Indiana alone. These figures represent approximately 1356 tons of dry waste, or according to classification, 624 tons of seed and 732 tons of skins. This staggering quantity of refuse naturally elicits the inquiry, "Why not salvage the discarded material to useful purposes?" The chief reason why this question cannot be answered in the affirmative is that the volume of waste at any particular tomato-pulping factory has not been sufficient to justify recovery. Then, too, the established value of these by-products in this country is of recent concern.

The investigations by the Bureau of Plant Industry, U. S. Department of Agriculture, as to the commercial possibilities of canning-house waste, have likewise developed a counter theory for assembling the material at a central establishment. With accessible localities contributing to the total tonnage at the central station, under the discussed plans, the quantity of available refuse would make its fabrication possible. Two essential products—tomato-seed oil and meal—are profitably recovered from the canning-house refuse. The oil is valued as an edible product as well as for its drying properties in the manufacture of paints and varnishes. The meal, a residue after the oil has been extracted, has the possibility of profitable utilization as a commercial stock feed.

The magnitude of the output of tomato refuse in the United States is suggested in a survey made by a representative of the Bureau of Plant Industry who personally inspected 21 of the principal tomato-pulping plants, and supplemented his observations by correspondence with additional enterprises. He estimates that 275,000 tons of tomatoes are pulped annually, and when supplemented by the tonnage of culls, he measures the total quantity of tomatoes thus utilized in terms of 300,000 tons. The wet waste from this tonnage will approximate 16,000 tons, which would yield 3000 tons of dry waste.

Tomato catsup, pulp, paste, puree and soup are the derivatives of crushed tomatoes, when ground in so-termed cyclone machines The latter machinery has been picturesquely described as power applications of the housewife's colander. By the commercial process the red pulp and juice are forced through perforations in a screen, while the skins, cores and seed are discarded as useless. Cyclone waste is the fitting description applied to the outlawed material. The quality of the tomato and the relative efficiency of the pulping plant are factors responsible for a variation in the ratio of refuse—ranging from four to ten per cent by weight. The dry seed constitute about one-half per cent of the tomato.

Cyclone waste consists of 80 per cent water. A method has been devised and operated on a factory basis whereby the wet seed of the tomato can be divorced wholesale (commercially speaking) from the remainder of the undried material. Such a system of seed separation, according to Dr. J. H. Schraeder, formerly a scientist in the Bureau of Plant Industry, will enable the producer to separate the seed from other waste at each tomato-pulping station. Continuous of operation, cheap and fool proof are among the virtues claimed for the new method. The advantages, obviously, are to make the producer independent of the necessity of shipping his waste to a central plant when exorbitant freight rates might deprive him of potential profits.

The observations as to the recovery of tomato refuse were gathered by Doctor Schraeder from waste-producing stations in Maryland, Delaware, New Jersey, New York, Ohio, Indiana and Illinois, the tonnage of raw material handled by these plants for the past five years. Cyclone waste from tomatoes was calculated to be five per cent. To assemble 12,500 tons of tomato refuse at

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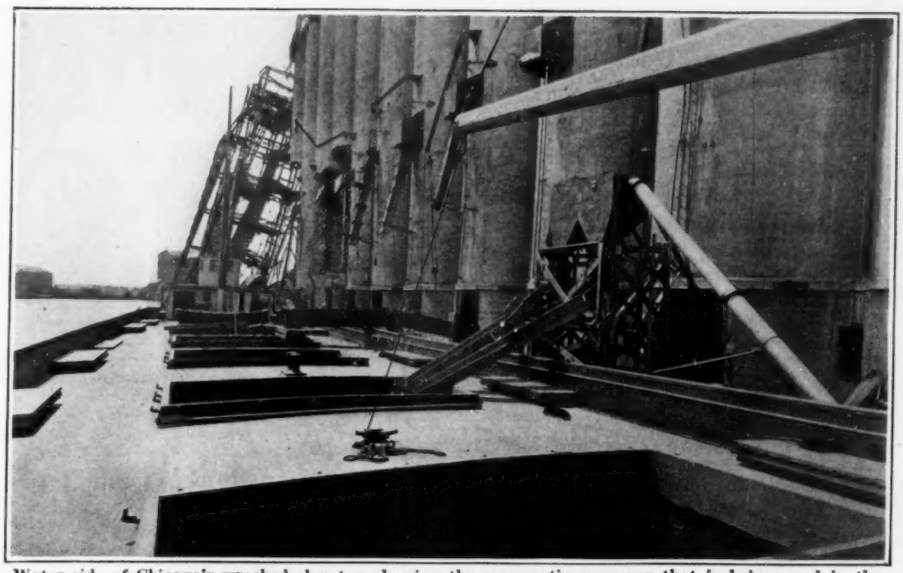


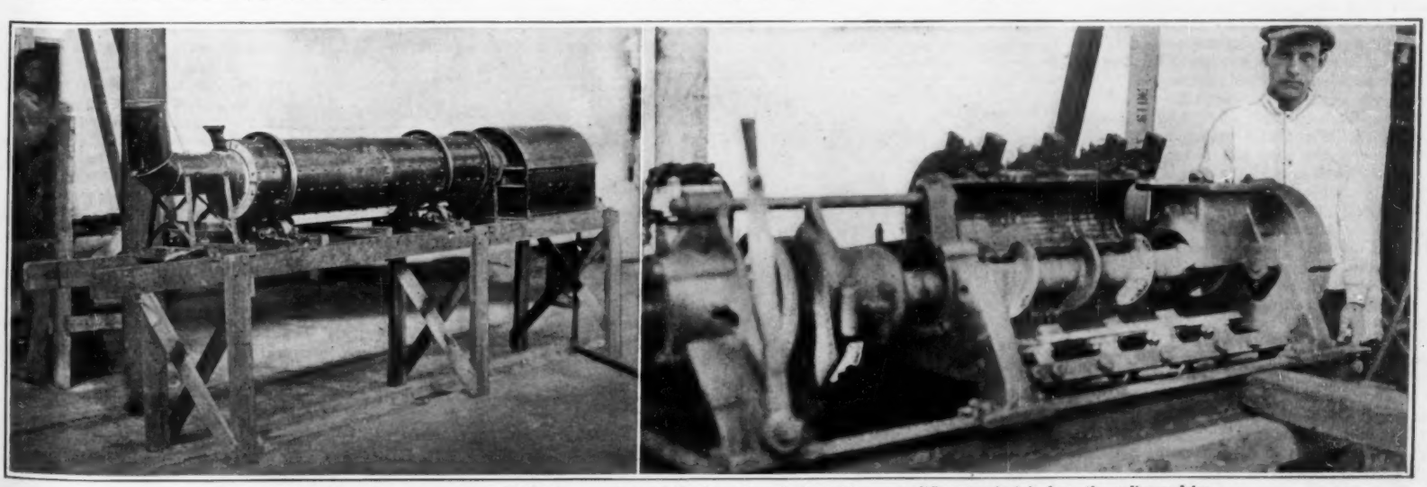
Water side of Chicago's wrecked elevator, showing the pneumatic conveyor that is being used in the salvage of six million bushels of grain

Salvaging Grain by Suction

FOLLOWING the dust explosion which wrecked a great elevator at Chicago came the problem of salvaging some 6,000,000 bushels of grain within and around the wrecked structure. The handling of this grain by scrapers, portable conveyors, trucks and manual labor was a slow process and it was decided to use the pneumatic method. Two conveyors were installed; one on the river front for discharging to steamers, and the other at the north side of the structure for loading the grain into cars.

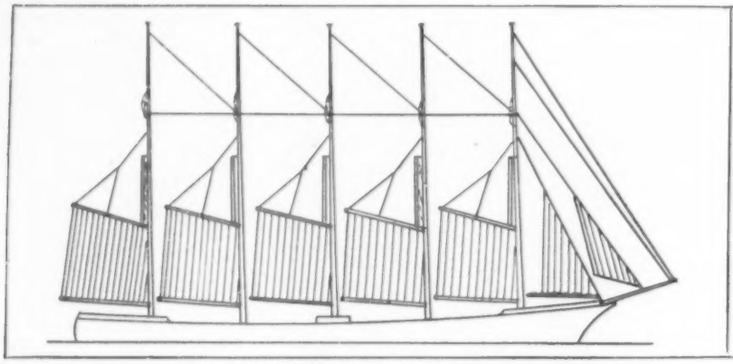
The use of the pneumatic system in salvaging this grain is resulting in a very marked saving in cost of handling. The labor involved is reduced to a minimum. Where a bin containing 30,000 bushels of wheat, oats or corn is to be emptied, the suction nozzle is simply placed under the bin and the gate casting knocked off. The grain is allowed to flow until the bin is emptied. Where the grain and concrete are en-masse, a flexible hose is attached to the suction duct and the method of operation is quite similar to the ordinary vacuum cleaner, except of course, on a much larger scale. To some extent the grain is cleaned and cooled by the suction conveyor. The heavy pieces of reinforcing steel, machinery parts and concrete will not enter the duct and miscellaneous fragments which do pass into the line are caught on a screen within the separator tank and cleaned out from time to time.

This is the greatest grain salvaging problem on record. The workhouse bins, with few exceptions, remained intact and these were readily emptied by an emergency track through the house and direct spouts to cars. Some fourteen great storage bins on the south side were blown open and with but little power available, scrapers, wagons, trucks and portable conveyors were put to work getting the exposed grain into cars placed on an old construction track. The double row of bins of the river house were more or less wrecked, allowing the basement of this section to fill with grain. The two hundred and twenty standing bins of the main plant, each with a capacity of 30,000 bushels were lifted as a unit by the force of the explosion and dropped back on their foundations. At the same time the blast toward the sides wrenched the bin spouts and many gates loose as though by the hand of a giant. Any attempt along the usual lines of salvaging here would have been extremely costly, as well as hazardous. The pneumatic method solved this problem; one or two men doing the work of the large gang that would have been required to pursue any ordinary plan of attack to its doubtful and perhaps even dangerous outcome.

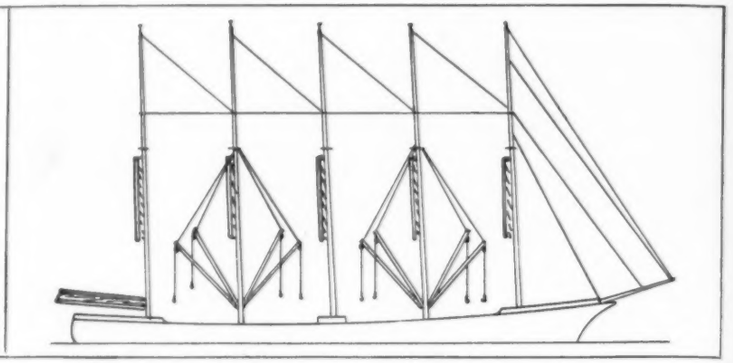


Left: Direct-heat drier for tomato seeds. *Right:* An experimental "moisture expeller" working on a different principle from the ordinary drier

Some of the apparatus by which the tomato seeds and skins may be salvaged in the catsup factory



Snugged down for heavy weather



At the dock; spars of lower sails used as cargo booms

The Motor Clipper

A Motor Sailing Ship That Can Compete with the Ocean-Going Tramp Steamer

By C. O. Liljegren

IN SCIENTIFIC AMERICAN for April 23, Mr. Rowland pictured and described a new auxiliary sailing ship, the "Motor Clipper," developed by the present writer during a lifetime of incessant study of the sailing ship problem. To make sure that the vessel was correctly pictured, the Editor has kindly asked me to supply missing details in her construction and fittings.

Frankly stated, the "Motor Clipper" is a development of and a cross between the American schooner and the racing yacht. The schooners when first seen by the writer in 1895, made an indelible impression because of their simple rig, great carrying capacity, and general handiness in comparison with the then common square rigger. At that time the first four-masted schooners, called "1111," were built and were considered to be wonderful; but there soon followed the five-masted schooner, to say nothing of the six- and seven-masted schooner, such as the "Wm. L. Douglas" and "Thomas Lawson," built at the Fore River shipyard about 1900.

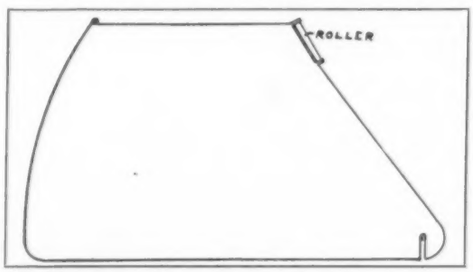
But while watching these schooners and comparing them with the yachts of the period, the writer soon found out that they were badly lacking in one essential point: they could not beat to windward. Consequently their voyages were badly delayed by headwinds, and heavy gales drove many of them on shore. In fact, just like a square-rigged ship, all schooners were in mortal danger every time a gale of wind drove them near a lee shore. Clearly this must be changed if the schooner is to come into her own.

Now, in order to beat to windward like a yacht, three things are necessary: an easy form of hull with small "windage," great stability, and leeway-stoppers. The United States had highly developed the *centerboard*. Why not use these on large schooners? Of course the writer knew that centerboards had been used on small schooners, but with only mediocre results; this because they were simply copied from the small sailing craft without due attention being given to the great friction in a big centerboard, and to the weakening influence of cutting a big hole in the middle of the vessel, where the strain is heaviest.

On the other hand, sideboards or *swords* have been used on Dutch merchant craft for many centuries with splendid results. In fact, whoever like the writer has seen the clumsy dutch "Koffs" and "Tjalks" beat to windward as fast as many a yacht in a strong wind, must get a profound respect for such a combination of carrying capacity and weatherliness. This proves conclusively the worth of leeway stoppers on merchant ships, for these "koffs," although almost square in their ends, and loaded to the deck line, still can make fast trips.

These swords are simply strong wooden boards attached to the outside of the vessel, and pulled out of the water when not in use. Clearly there must be a limit in the size of the vessel where such simple contrivances can be used, just as with the centerboard. Both can be used only on vessels under 300 tons' register; but what about duplicating the leeway stopper? In fact, twin and even triple swords had been used in Holland about the year 1600, and double centerboards have been used on small sailing canoes from 1875 to this very day with the very best results, although now the after board is incorporated with the rudder and thus is movable both up and down as well as sideways. Naturally a drop rudder cannot be used on a 5000-ton merchant ship, but the principle is the same whether applied to a canoe or a ship. And a single big centerboard will not only be heavy and unwieldy, but will make a big vessel so difficult to steer that it is quite out of question.

Hence the "Motor Clipper" was given two centerboards which are useful in many ways in addition to stopping leeway. By their use any vessel can be kept on a



Steel centerboard with anti-friction roller

straight course with very little rudder work, simply by regulating their depth below the keel. In tacking, the boards are raised and lowered alternately, so that missing stays is never to be feared. Of course some "experts," as usual, will say "It can't be done"; but they are always interrupted by someone who comes along and does it. The two centerboards have not yet been tried on a big ship, but they work to perfection in the big model of the "Motor Clipper" herewith illustrated, keeping it on a straight course. Whoever sailed a model ship will understand the difficulty; note the photograph of this model with all sails set, and going at a good speed. It is now a well-known fact that models make possible an estimate of the behavior of a full-size ship of the same proportions and form.

In a big ship the chief difficulty would lie in the raising and lowering of the centerboards on account of the heavy pressures and resulting friction. To overcome friction, rollers are necessary, or some kind of ball bearings. Our illustration shows the conical, self-adjusting roller introduced by the writer, applied at the point of maximum effect. The big end bearing is slightly tapered and allows the roller to revolve evenly and in full contact with the centerboard case. The roller almost fills the case sideways, in order to reduce the unpleasant "slapping" of the board in a seaway in light airs. The actual raising and lowering is done from the bridge of the vessel, through a small motor (electric), winches, and strong iron chains, with the cargo winches as a reserve in case of need. The chain needs to be very strong, but in case of a break the board is made to drop out automatically so as to not endanger the tightness of its case; or it can be caught by a wire rope under the keel.

In a wooden vessel it was almost impossible to make the case watertight, but this is comparatively simple in a steel ship, and need not cause any anxiety except in grounding. On the other hand the forward centerboard will give warning of shoal water, possibly in time to save the ship. And if the board be bent, it can be dropped at will. Such things count as dangers of the sea against which no vessel can be made proof.

Wind power as compared with steam power costs nothing beyond the relatively small outlay for a ship's sails, masts and rigging, and subsequent repairs. It is largely a question of applying wind power scientifically. Unlike every other source of power, it can actually work against itself, and force a ship to windward against the very wind that drives it forward. The machine-driven vessel's main advantage lies in being to a certain degree independent of wind and weather. If the same independence can be secured in a sailing vessel, even granted a decrease in speed, the sailing ship must ultimately prove a serious competitor of the mechanical ship for certain classes of freight and service.

Practical sailing men, that have seen hundreds of sailing ship logs, agree unanimously that only calms and head winds have prevented sailing ships from making just as smart passages as any tramp steamer. For taking a ship through calms some kind of machinery is clearly necessary, but it must be cheap, easily applied, and like the "maid of all work," be put to many uses on board: propulsion, hoisting cargo, sail handling, lighting, pumping, etc. And above all, the machinery must not *spoil the sailing qualities of the ship:* it must be strictly auxiliary. This condition rules out all twin screws because of the extra cost of duplicating the machinery. In December, 1916, the writer warned strongly in the *Pacific Marine Review* and other shipping journals against twin screws. The warning was very little heeded by shipowners; but many sailing ships with twin machinery are removing it. This has been done by

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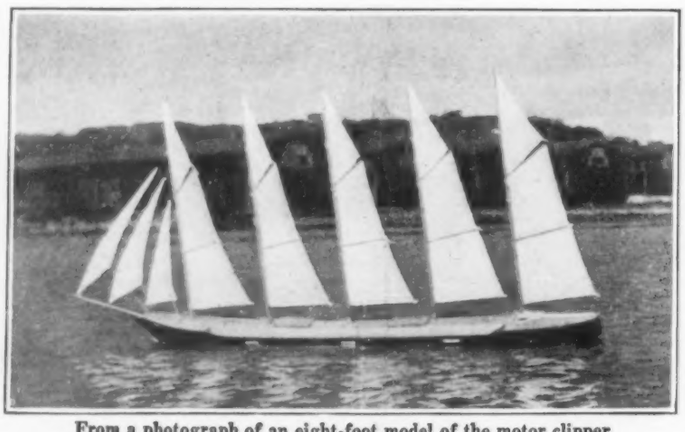
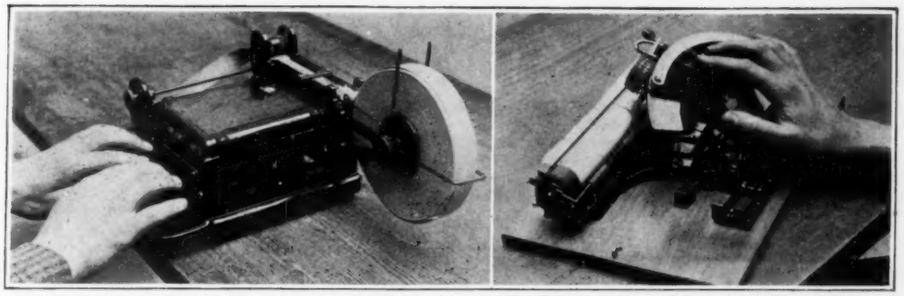


From a photograph of an eight-foot model of the motor clipper ship, under way

Typewriters for the Blind

ALTHOUGH it has been demonstrated that the blind man can learn to operate the ordinary typewriter with a fair degree of success, this machine is after all not suited to the sightless operator. German inventive ingenuity for some reason has paid more attention to this matter than we have on this side of the water, with the result that at least two very acceptable machines have been put out, so designed that the handicap of the man who cannot see is reduced to its lowest terms. The one is merely a substitute for the usual typewriter, and compares rather poorly with it in speed. The other is something more than this, being designed for letters of which numerous copies are wanted. The letter is taken from oral dictation in the first instance, and typed, in Braille characters, on the tape. Then this tape is run through the instrument under the blind operator's fingers, and he types off, in the ordinary alphabet, as many copies as are desired. Both machines are distinguished by having the keys marked in Braille characters, so that the typist can the better detect an error.

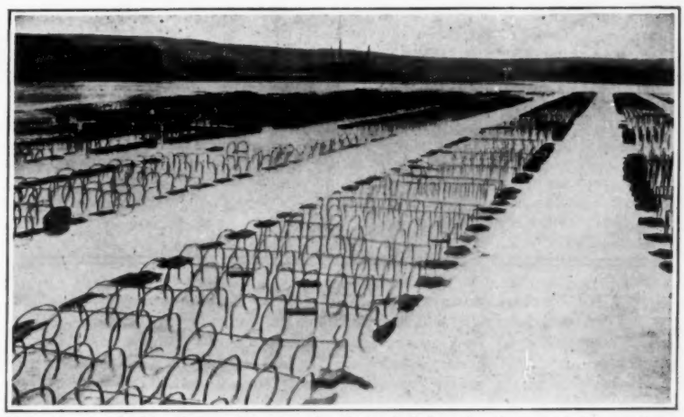


Left: The machine with which the operator takes down the notes on a Braille tape, the notes being afterwards read from the tape by the sense of touch and then transcribed. *Right:* A miniature typewriter of more conventional design for the sightless operator

German typewriters for blind workers

A Mystery Picture and Its Explanation

THE reader might be allowed a generous number of guesses as to the subject of the curious picture presented herewith, with considerable confidence that he would not hit it right. These mysterious bows do not represent chair-backs, nor yet scrapped submarines; they are merely some 2000 motor trucks that were submerged to the point shown by the flooding of the Rhine bottom lands where they stood. They are the property of the American Army of Occupation, and were waiting for somebody to come along and find a use for them when the flood overtook them. It will be seen that the tarpaulin bows and, in some cases, the tops of the cabs, are all that is visible. But the trucks stood up so well under their prolonged wetting that they were successfully salvaged, and it is even said that they are being sold now in the United States.



Two thousand American motor trucks, intended for the Army of Occupation, submerged in the waters of a Rhine flood

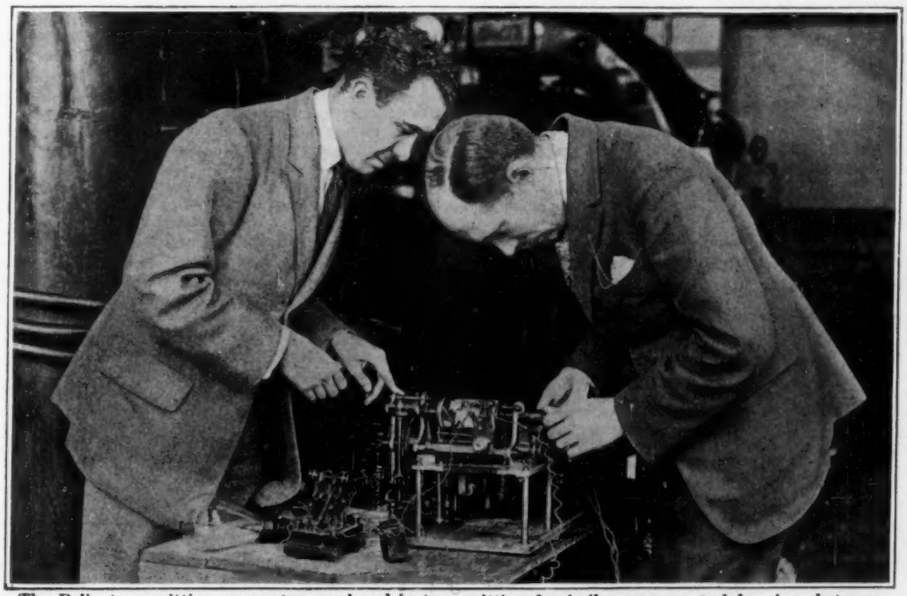
Oil for Greenhouse Fuel

COAL is the common fuel used in heating greenhouses. In the United States the industry engaged in producing flowers and vegetables under glass is extensive, and for reasons which can readily be appreciated, the coal strike brought its worries to the men with large investments in greenhouses. An interesting new development in this industry, partly traceable to the difficulties of coal shortage, is the adoption of oil for fuel.

New England claims to have the pioneers in this new use of oil for fuel. Two florists near Providence have equipped their houses with oil-burning apparatus, the installation being sufficient to heat their whole ranges. More recently, in the great Arlington market garden district near Boston, a leading market gardener has adopted oil fuel. Interest in these most intensive of horticultural industries is so intense that the special Market Gardeners' Experiment Station at Lexington, Mass., is installing oil-burning apparatus, and will collect official facts and figures bearing on the desirability of the new fuel.

From the standpoint of the veteran greenhouse man, there is a bigger side to the change from coal to oil than recent coal strike experiences suggest. He is intensely interested in oil because of what help it may contribute to a solution of acute labor problems. With oil it is not necessary to shovel coal or take out ashes. Oil, it is declared, maintains a remarkably even heat, with a minimum amount of attention keeping the greenhouse temperature exactly as desired.

If early results are confirmed, there is sure to be a rapid drift into use of oil instead of coal. We may yet see the day when the greenhouse which is a coal-user will be regarded as a curiosity. Market gardeners and florists are typically enterprising men, and in a situation of this sort will let no grass grow under their feet.



The Belin transmitting apparatus employed in transmitting facsimile messages and drawings between Annapolis, Md., and Malmaisson, France. Note the big generator in background

Transmitting Photographs and Drawings by Radio

FOR some time an interesting series of experiments has been under way at the large radio station at Annapolis, Md., having as the object the transmitting of photographs and drawings by radio to a receiving station at Malmaisson, near Paris, France. This series marks but another step in the development of the Belin system of photographic transmission, which was described in our columns last November when M. Edouard Belin succeeded in transmitting photographs between St. Louis and New York City over the usual telegraph lines. This time, however, the transmission is by high-power radio, which obviously introduces a number of complications.

The Belin principle is quite simple and ingenious. The photograph to be transmitted is transferred on to a brass cylinder and so treated that its image is reproduced in high relief. The cylinder is then placed in the transmitting unit, where its irregular surface presses against the stylus of a sensitive microphone. The irregular surface varies the pressure on the microphone and hence its electrical resistance, and in that manner modulates an electric circuit in direct proportion to the photographic values. A special synchronizing device sends out a synchronizing signal at regular intervals.

The receiving side consists of a highly sensitive Blondel oscillograph, which carries a tiny mirror on its strings. The strings are placed in oil so as to make them dead-beat, while the mirror swings about on its vertical axis. A source of light casts its rays on the mirror, which in turn reflects them on to a screen of graduated transparency, behind which is a drum covered with a piece of sensitized paper. This drum turns in perfect synchronism with the transmitting drum through the means of the synchronizing signal and special mechanism, which our available space does not permit us to describe here. As the modulated current or signal strength reaches the receiving end, the tiny mirror is deflected more or less so that its beam falls on any part of the graduated screen that corresponds with the image at the transmitting end. In this manner more or less light falls on the sensitized paper of the cylinder, which is then developed in the usual manner.

A simpler transmitter and receiver arrangement calls for a plain make-and-break device at the transmitting end, operated by the surface irregularities, and no graduated screen at the receiving end. This arrangement is for the transmission of drawings, cartoons, facsimile type matter or handwriting, maps, and all other matter in plain black and white, without the half-tone gradations of the usual photograph.

In the present experiments, which are being conducted by Messrs. Marcel Touly and Gaston Johanneau of M. Belin's staff, only plain black-and-white transmission has been undertaken thus far. The difficulties encountered have been mostly in the way of getting the Belin apparatus to modulate the powerful output current of the big arc generator at Annapolis. Over sixty relays have to be actuated in order to handle the transmitting current, and it stands to reason that in this large number of relays some

(*Continued on page 173*)

Industrial Alcohol

Where It Is to Come From, and Some of the Things We Are to Do With It

By Harry A. Mount

ATTENTION has already been called, in articles which have previously appeared in the SCIENTIFIC AMERICAN, to the growing importance of alcohol as a fuel. The prospect is, indeed, that within the span of a very few years, alcohol or fuels with an alcohol base will largely or entirely replace gasoline as a fuel for motor cars. But as important as this prospect is, it can hardly overshadow the general industrial usefulness of alcohol, especially in the chemical industries, which are just coming to the fore in America.

The making of alcohol has been an accomplishment of nearly every race for some 3000 years, but the product was used largely for beverage purposes. It is only within comparatively recent years that alcohol has come to be of commercial importance and the history of commercial alcohol is even more recent in this country. The industry in nearly all countries has so far labored under two severe handicaps. Alcoholic drinks have been a favorite source of governmental revenue and it has taken a long time to convince taxing agencies that they ought to differentiate between alcohol for beverage purposes and that used in industry.

Before the war very little industrial alcohol was used in this country. The first large plants furnished the alcohol with which we made munitions for the allies before the United States entered the war. Later large amounts were used to supply our own armies. It has been stated that approximately 52,847,117 proof gallons of denatured alcohol were used in supplying our armies with explosives, poison gas, etc. It is apparent that in time of war a well developed alcohol industry is essential. It is undoubtedly true that one of the contributing reasons for Germany's strength was her large alcohol plants, which in 1912 were producing over 41,000,000 United States gallons annually for commercial purposes.

Beginning with a production of 3,084,950 gallons in 1907 the alcohol production in this country grew gradually until in 1914 the production was over 17,000,000 gallons. In 1916 the production had jumped to 84,000,000 gallons and in 1918 over 90,000,000 gallons of denatured alcohol for industrial use was produced. Practically all of this alcohol was used in the country and the large increase can be accounted for by the expansion of the dye and other chemical industries.

It would be almost impossible to enumerate all of the industrial uses for alcohol. But even a brief survey of the field cannot fail to be impressive.

The most important use for industrial alcohol is that of a solvent. Indeed, chemists say that the only solvent of equal importance is water. Alcohol as a solvent for dyes and confectioners' colors is of great importance. In the development of gelatine food products considerable alcohol has been used as a solvent for the coloring matter. If it were not for the solvent properties of alcohol we would not have such commodities as perfumes, liquid soaps, toilet waters, liniments, flavoring extracts, etc. Large quantities are used in this country in the making of "solidified alcohol" as a fuel under chafing dishes and small portable stoves.

Alcohol is used as a raw material in the making of ether, mercury fulminate, chloroform, certain toxic gases such as mustard gas, and in many other drugs and chemicals. Alcohol lightens the housewife's burden in many well-known ways. Its medicinal value is also well known and large quantities are used in hospitals.

Alcohol is also used in quantities as a dehydrating agent in the manufacture of photographic films and in the preparation of photographic prints. It is used as a precipitating agent in a number of chemical processes. It enters into the manufacture of inks, celluloid, shellacs, disinfectants, etching solutions, soldering fluxes, etc.

After exhaustive tests of various anti-freeze mixtures for auto radiators, the Bureau of Standards has recommended alcohol as least harmful.

A British Government report reveals the use of alcohol in important quantities in the making of many other articles, as electric lamp filaments, linoleum, felt, fireworks, matches, steel pens, artificial silk, rubber, printing, dyeing and cleaning operations in laundries, etc.

Some idea of the tremendous importance of the industry can be gained when it is realized that this is only a partial list of the uses to which alcohol is put, and that new ones are being constantly added.

One of the newest, for instance, is its utilization in the purification and separation of gum turpentine. Only a small percentage of the resin produced now is marketable because of bad color. It has been found that gum turpentine is soluble in alcohol and foreign matter, such as twigs and insects, can then be easily removed. Distillation separates the alcohol, which can be used again, from the turpentine and resin, which are clear and of the highest grade.

With all these uses the factors of production and price are vital. "When will we have cheap fuel alcohol?" is a question rivaled in importance only by the other one, "Why is alcohol so high?" The chemist insists that the raw materials for the making of alcohol are on every hand in limitless and permanent supply; that the extraction of alcohol is one of the simplest of all chemical processes; that alcohol fuel is more satisfactory than present-day gasoline; in a word, that alcohol offers a permanent solution for the serious fuel problem caused by a shortage of petroleum.

Small consolation this for the motorist who continues to buy fuel for his car that costs more and more and is of constantly declining quality! The supply of gasoline already is less than the demand and the promise for the immediate future is less fuel and more motor cars. If alcohol can make good as a motor fuel isn't this the time to do it? Why hasn't the chemist made good his promise?

TO the average citizen "alcohol" is that forbidden ingredient of certain beverages which imparts thereto the so-called "kick". As a matter of fact, alcohol is no doubt the most important of all chemicals useful in our industries. Millions of gallons of it are used each year in the production of an almost endless list of commodities. Some industries depend upon alcohol for their very existence, for there is no substitute for it in certain operations. And both the production and usefulness of industrial alcohol are increasing in this country at such a rapid rate that it is becoming a very large factor in our economic situation. This is the story which Mr. Mount has for us this week.—THE EDITOR.

These are some of the thoughts of the average motorist who has followed the fuel situation in recent months. And to add to his confusion there have appeared such statements as those of a Brooklyn inventor that he was ready to place on the market a motor fuel to sell at five cents a gallon, the base of which is alcohol. And then comes the following, credited to Henry Ford:

"I am now making the best fuel my tractors can use out of straw. I have an inexhaustible supply of fuel on my farm and believe the day is coming when we will extract the alcohol out of fruit for fuel and use the rest for food. I am putting up a $35,000 plant now to manufacture alcohol from straw alone; just to show people that it can be done."

The "Inventor" referred to above is now in jail and his five-cent fuel is branded as a swindle. A famous authority on industrial alcohol says of Mr. Ford's well-intentioned effort:

"This process is still of an experimental nature and has no commercial significance at present."

As for the chemist he has done his work well and he is now able to convert into alcohol a great variety of substances, many of which are now wasted, but he has run plump into the laws of economics and so far his product is not able to compete with gasoline in price.

It can readily be seen, therefore, that the importance of alcohol as an immediate savior for the motorist ought not be overestimated. But on the other hand the importance of this fuel a few years hence ought not be overlooked. It is the purpose here to outline briefly the problems the chemist faces in developing a cheap alcohol fuel and to tell how he has set about solving them.

There are several methods of deriving industrial alcohol. The one used now almost to the exclusion of all others is the fermenting of a mash from some material containing a large amount of sugar or starch and distilling and refining the resultant alcohol.

The process is very simple, although some of the latest apparatus for producing large quantities of alcohol continuously is rather complicated. The fermentation process has been in use for some 3000 years and chemists are ready to admit that there is small chance of any large improvement. There is a large number of possible raw materials for this process including most of the grains, many tubers such as potatoes, turnips, mangolds, etc., nearly all fruits, molasses, and other materials.

Large quantities of industrial alcohol were made in Germany before the war from a potato grown especially for the purpose. In this country much of the alcohol is manufactured from "black strap" molasses, which until a few years ago was a waste product of the Cuban cane sugar industry. The chief difficulty is that all of these products, which are available in sufficient quantity, are also useful as food and their price does not depend on the alcohol they will produce, but on their value as foods. A writer in the SCIENTIFIC AMERICAN has recently pointed out that if one-fourth of our corn crop of last year had been used to produce industrial alcohol, there would have been an amount equal to our gasoline supply. This is an interesting speculation, but engineers engaged in the serious business of producing alcohol point out that if such a large part of our corn crop had been diverted to the making of alcohol the price of corn, and consequently the price of alcohol, would have soared to impossible heights. They are agreed that there is very little hope of cheap alcohol so long as we must depend for raw material upon products which can also be used as food.

There are, however, many materials from which it is theoretically possible to obtain alcohol, which are about us in inexhaustible quantities and which are not used for food. Alcohol may be had from any material containing cellulose, such as wood, grasses and vegetation of all kinds. As Mr. Ford has shown, it is perfectly possible to make alcohol from hay or straw, but the difficulty is with the process. It is first necessary to break down the cellulose so that sugar is obtained and this is fermented in the usual way. It requires, however, a complicated process and a large amount of power to first obtain the sugar. The process has proved so expensive that the alcohol from this source cannot compete in price with that made from food products. There is, of course, the chance that someone will find a way to do this cheaply but the odds are against any such discovery because some expense will always be necessary before the starting point of the fermentation process is reached.

Is there, then, no chance that we shall have cheap alcohol? There are at least two recent developments which hold very great promise, although neither of them is as yet commercially practicable.

In one of these the bacteriologist has come to the rescue with the promise that he will soon discover a "bug" or bacterium which will have the power to convert cellulose materials directly into alcohol. The promise is a plausible one for the reason that this very thing has been done on an almost infinitesimally small scale. It is admitted that a new bacterium mus be found to accomplish the result on a commercial scale. An intensive search for this "bug" is being made by competent scientists and there is very good reason to hope for success. If this search ends favorably the effect will be revolutionary.

The second basis for the hope that cheap alcohol is not far off is in experiments, being conducted largely in Europe, to extract alcohol from mineral sources. A chemical engineer who has just returned from an investigation of activities reports that very great progress is being made and that literally hundreds of experiments of a more or less extensive nature are going on. Europe has always led America in the manufacture of industrial alcohol chiefly because we have so far been blessed with a plentiful supply of petroleum, which had only to be taken from the ground.

(*Continued on page 173*)

From Swords to Plowshares

A Survey of the Post-War Activities of the Huge Krupp Works

THE Frederick Krupp Corporation comprises the cast steel manufacturing plant at Essen, the Gruson Works in Magdeburg Buchau, the Germania shipyard in Kiel, the Frederich-Alfred Mine in Rheinhausen on the lower Rhine, the Annen Steel Works in Annen, Westphalia, as well as the independent Middle Rhine industries, the iron and coal mines, the land that was formerly the proving grounds at Essen, Neppen and Taugerhutte, and many other units.

On July 1, 1914, all the above plants and mines employed 80,824 workers, of which number 41,796 worked in the Essen Plant. It was generally believed the world over, before the war that the Krupp Works manufactured war material only. But few people know that war material actually formed but a very small percentage of the total output of these works. The importance of the company as regards production of peace products, can best be judged by the fact that it supplied 1/5 to 1/3 of all Germany's railway materials, such as rails, ties, wheels, axles, frames for locomotives, boilers, fireboxes and forged pieces. There are, therefore, very few trains in Germany that are not fabricated out of Krupp steel.

The principal articles manufactured in the Krupp foundry before the war were: Steel pieces of all qualities (especially high grade steel) special automobile and tool parts; railway and shipbuilding material. Among the finished products war material was first, such as cannon with full equipment, ammunition, rifle barrels, armor and huge armor plates. At the Gruson Works stampings and forgings for mining and cement-making machinery were manufactured.

The Germania shipyards at Kiel built battleships, fast passenger and freight steamers, floating dry docks, turbines, oil engines, boilers, etc.

The Frederich-Alfred Mine supplied iron ore and timber as well as most everything made from these materials, such as bridges, buildings, etc.

The declaration of war on August 2, 1914, necessitated a radical change in the interest of National defense. Plans for increasing the output of the organization were immediately effected, the plants operating on a peace basis being far from adequate to meet the situation. The Gusstahl Plant in Essen alone was enlarged from 241.2 to 395 acres. The number of employees in the Essen Plant increased from 41,796 to 114,000. Similar increases were effected in all the other plants bringing the total employed in 1918 to more than 172,000.

The armistice conditions and the Peace Treaty of Versailles made it necessary for the organization to revolutionize its gun and ammunition works. On the other hand the open hearth furnaces and wood working plants continued operation as usual as long as the coal supply lasted. It was more difficult to find work for the men who had made war materials only. In the steel works at Essen, after the armistice, the first work done was the repairing of locomotives and cars, which was a necessity on account of the heavy wear and tear on rolling stock during the war. At the same time the manufacture of locomotives and cars was begun. The construction of this railway equipment was accomplished in parallel buildings composed of 19 shops having a floor space of 74,000 square meters (796,000 square feet) in which today 5000 men are employed, giving an annual output of 300 heavy locomotives and tenders and 2500 15-ton cars. The manufacture of commercial automobiles, trucks for special purposes, agricultural machinery and machinery for the textile and paper industries is carried on, as well as that of internal combustion engines, turbines and machines for making office furniture, counting and adding machines.

By taking up all these industrial branches it was possible in a few weeks to resume working with the force which the armistice cut in half. There was a gradual increase, until on July 1, 1921, more men were employed than before the war. The working day was reduced from 10 to 8 hours, so that a greater force was required to produce the many lines.

The program of the Essen Works, including the production of the raw materials which were made before the war, includes the following:

Special steel, rolled, forged and in condition for further processes. Casting steel, forging steel, cast iron, silico iron for casting, steel rolls, steel plates for safes, tool steel, pressed steel, tin and tin articles, spiral leaf and other springs, gears, bolts and nuts, drills, metal packing, compressed air tools, pumps and hydraulic machinery, gear boxes for steam, water and electric-drive machinery, starting motors, roller bearings, mine cars and counting mechanisms.

Cast steel shapes (structural steel) for shipbuilding and forgings, crude oil motors, marine oil engines, marine gear boxes, steam boilers and Diesel engines, electric tools and lifting magnets. Precision tools and instruments, cash registers, motion picture projectors, locks, keys, surgical instruments of all non-rusting steel.

Milk separators, potato-diggers, reapers and binders, mowing machines and tractors for all the above. Spinning machines and parts and machines for paper making and textile industry. Locomotives, freight cars, including automatic dumping cars and complete railroad signal, roadbed and overhead equipment. Steel and steel products for automobile and car construction, motor trucks, street sweepers, sprinklers and washers, mill refuse wagons with tractor; motor road rollers, industrial cars, locomotives and cable system; steel and steel products for aircraft industry.

Besides all the difficulties which the change brought about, the corporation naturally has to suffer from the economic stress of Germany. The coal shortage which was aggravated by the conference at Spa, is felt in all the works, especially where raw products are produced. Most of these latter works had to close down. The reduced output of such products of raw material diminishes the quantity of finished products. It is true that the increased use of "wood" coal (brown in color) in place of anthracite, or in combination therewith, helps out to a certain extent.

From this general coal shortage in Germany, the Krupp Works suffer the most, but they naturally cannot change the situation.

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

The Height and Velocity of Flight of Migrating Birds

To the Editor of the SCIENTIFIC AMERICAN:

On reading your note in the SCIENTIFIC AMERICAN of July 9, concerning recent measurements of the velocity of flying birds, it occurred to me that two instances of trigonometrical measurements of the height and velocity of migrating ducks and geese, may be of interest. From *Science*, January 1, 1897, I quote:

"Measurements of the heights and velocities of clouds are now being made at the Blue Hill Meteorological Observatory by Mr. Rotch as part of an international scheme for such work. The measurements are made with specially constructed theodolites in which a large conical tube with crossed wires at one end and an eyepiece at the other replaces the ordinary telescope.

"On the morning of December 8, while Mr. S. P. Fergusson and I were engaged in measuring clouds, a flock of ducks passed across our base-line, which is 2590.3 meters in length. We succeeded in getting one simultaneous set of measurements on the apex of the flock from which its height was calculated, and one or two independent subsequent observations, from which the velocity was calculated. The height was 292 meters above the lower station, which is situated in the valley of the Neponset River.

"The velocity of flight calculated from this measurement of height, and from the angular velocity measured at one end of the base-line is 21.4 meters per second, and from the angular measurements made at the other end of the base-line is 21.3 meters per second. The wind was very light, having a velocity of only one meter per second, according to the automatic record made at Blue Hill Observatory, 180 meters above the valley station. The direction of the wind was from the north, and the ducks were flying from the northeast. These observations were not in our program, but they may prove of interest to ornithologists and students of aeronautics.—H. Helm Clayton, Blue Hill Observatory."

Again, from *Science*, of April 9, 1897:

"During the three days ending March 22 numerous flocks of geese were seen migrating northward, or rather northeastward, since they were following the general trend of the coast line, which, in New England, is nearly northeastward north of Cape Cod. On the morning of March 22, while Mr. A. E. Sweetland and I were measuring clouds, at the ends of a base-line 1178.4 meters in length, extending from the Blue Hill Meteorological Observatory to the base of Blue Hill, we succeeded in measuring, with our cloud-theodolites, the height and velocity of flight of one of these flocks of geese. So rapid is the velocity of flight that the flock was visible to the observers only about two minutes, but during that time two sets of measurements were taken with the theodolites on the leader of the flock. The first measurements, at 8:49 a.m., were accurately taken at the Observatory station, but were only approximate at the other station. The second measurements, at 8:50 a.m., were accurate and simultaneous at both stations. Using the second set of observations at both stations for the height and the two sets of observations at the Observatory station for velocity, the calculations gave the height as 276 meters above the Neponset River valley, or 293 meters above sea level, and the velocity of flight as 19.8 meters per second. The direction of flight was from southwest to northeast.

"The self-recording instruments at Blue Hill Observatory, 180 meters above the river valley, showed that the wind at the time of the measurements was from west-northwest with a velocity of 4 meters per second. The height calculated from the first set of observations at the two stations was 283 meters above the river valley. This result, though not considered strictly accurate, serves as a good check on the adopted value which is given above. On a previous occasion as described in *Science* of January 1, p. 26, we found a flock of ducks flying from the northeast at a height of 292 meters with a velocity of 21.3 meters per second. The close agreement between the two results is suggestive, though it may have been accidental."

At the time, we were informed by ornithologists that these were the first measurements of the kind ever obtained. I have not learned of similar measurements since 1897, except those you refer to, but am very unfamiliar with the literature of ornithology.

A base-line less than 400 meters in length should be sufficient for observations of this kind, and need not be equipped with telephones. The accumulation of a satisfactory amount of data for birds of all kinds is likely to require much patience, at least in the Eastern States, for the reasons that usually only one or two observations can be secured on any flock of birds in flight, and it is necessary for the observers to be on the alert continuously during long periods of time.

S. P. FERGUSSON.

Washington, D. C.

Something New (?) in Brick Walls

To the Editor of the SCIENTIFIC AMERICAN:

I was interested in an item under the above title in your issue of July 9, 1921. "Something New in Brick Walls Using Standard Bricks"—King Solomon was right—for in the year 1880 I rented a house at Walton on Thames about 40 miles from London which had walls built as described (I would judge it to have been about 70 or 80 years old at that time), and found it so cool and comfortable that I continued my tenantcy to Christmas and found it both warm and dry in the winter. I can most strongly recommend this construction but it is not new.

E. F. BATEMAN.

Saskatoon, Sask.

The Paradox of Civilization

To the Editor of the SCIENTIFIC AMERICAN:

The writer of the editorial under the above head in your paper for July 30th, is evidently alarmed over the approaching exhaustion of our coal deposits. He seems to infer that as soon as the coal has been all consumed the savage and barbarian will again be masters of the earth.

Would it not seem more reasonable to prophesy that, as the time draws near when the coal will be gone, the need for power, heat and light will be met by substitutes, perhaps better than coal, without coal's drawbacks and inefficiency? There are many sources of energy which could, within the bounds of possibility, be developed to take the place at present held by coal. Among them are water power, solar heat, alcohol produced from vegetation, the vast reservoir of energy stored in the earth's interior, the wind and the waves. Why despair of the future of civilization merely because we may burn up all the coal?

East Canaan, Conn. D. C. CANFIELD.

Virgin jungle, cleared and plowed for the planting of young rubber trees

Cultivated Rubber

How the "Plantation" Has Made It Possible for the Grower to Keep Pace with the Demand

By G. A. Orb

IT is a pertinent fact in the world of today that the wheels of industry must never stop: mills and factories must operate day after day—the demand is ceaseless. Hence when Mother Nature moves too slowly to supply these demands of modern industry with sufficient raw materials for its insatiable maw, then must the brain of man come on the job and devise ways and means to meet the ever-increasing need.

No greater romance is to be found in the world of industry today than that of rubber: rubber, not alone for tires that do heavy duty in the commercial pursuits or transport my lady on her round of pleasure, but rubber for the thousand and one other needs of mankind.

It seems a long way from the jungle of the tropics to the automobile tire; yet had this same jungle not been made to produce instead of being merely a shelter for wild life, motor transportation would not be where it is today.

Two decades ago "experts" declared that if the automobile industry was to develop much further it would be necessary to find some other resilient substance than rubber from which to make automobile tires. Yet a far different result has been accomplished; not only do we have sufficient rubber for tires but for a thousand uses never dreamed of in 1900.

Cultivation of rubber was first attempted in 1876, when the seeds of the Para tree (*Hevea Braziliensis*) were planted in Kew Gardens, London; the next year it was introduced into Ceylon, and later into the Federated Malay States, Straits Settlements, southern India, Sumatra, Java, and Borneo. And it was in 1900 that the first trees of these far eastern plantations came into bearing, producing four tons of rubber. In 1907 the production of cultivated rubber had increased to 1000 tons and in another decade to 200,000 tons: while the output of wild rubber had remained practically stationary at 40,000 tons a year. About 80 per cent of the 700,000 tons of rubber produced annually is now cultivated.

In 1916 a leading American rubber company decided to make certain a sufficient supply of crude rubber by starting its cultivation, placing William Vaughan—an authority on rubber cultivation—in charge. A 20,000-acre tract in Sumatra was purchased, native labor cleared the virgin jungle, miles of modern railroads were built, proper quarters furnished for the 7500 natives employed on the plantation, and today much of this tract has the appearance of a city park.

When the car owner sits comfortably in his luxurious car, speeding over roads of every character with little inconvenience, little does he realize the many processes to which the rubber in his tires has been subjected in order to obtain the resiliency and wearing qualities that makes motoring a pleasure.

Plantation rubber—or cultivated rubber—is much preferred by the manufacturer for the reason that it arrives in this country in a far superior condition to that of native rubber. Difference in freight cost, shrinkage, and ease of handling are matters of very great importance to him; and wild rubber comes on the market with from 10 to 50 per cent moisture and foreign substance in its composition, while the Far Eastern cultivated product is exceptionally uniform. This uniformity is due to the scientific methods of coagulation and preparation; yet it has as great tensile strength as the finest grades of Para.

Ordinarily it takes the young rubber tree five years before it begins to bear latex—a thick milky fluid, slightly alkaline, containing three per cent proteids, traces of sugar and mineral salts, about 58 per cent water and 35 per cent rubber.

Natives gather the seeds of the rubber tree—which are about the size of the hickory nut—and plant them in nursery beds. At the end of six months the seedling has reached a sufficient growth to have the top cut out, a process known as "stumping." This causes several shoots to spring out; these grow rapidly, and at the same time the plant becomes hardy enough to withstand the attacks of the white ants.

After burning over the ground—clearing it of trees and underbrush—these young trees are planted some 20 feet apart, allowing about 100 trees to the acre. Afterward the ground is carefully kept free of weeds and grass that the trees may have every particle of nutrition that the soil affords.

When the trees are old enough to begin to yield latex, they are ready to be "tapped." Just underneath the outer, corky bark lies the layer of cortex cells—a layer some 3/16 of an inch thick and having a slightly pinkish tint: it is in this layer that the latex cells are found. They run vertically, up and down the trees,

(*Continued on page 175*)

Left: Natives doctoring young rubber trees to keep them healthy. *Right:* Sumatran natives drying and sorting rubber for packing

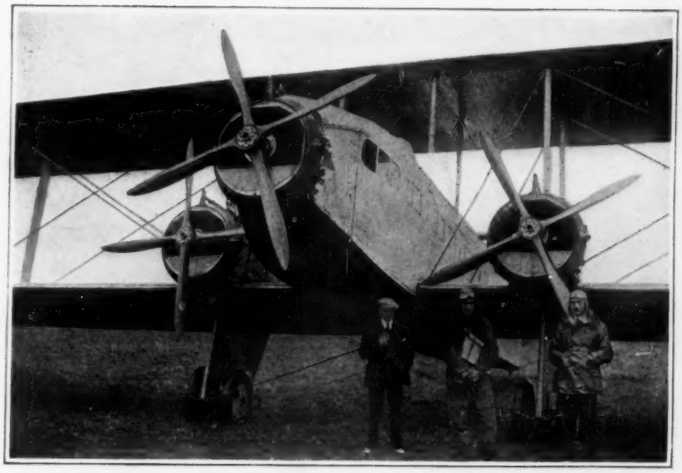
Two operations that distinguish the rubber plantation from the older method of jungle stripping

A Survival of the Fittest Among Airplanes

THE French public, which has ever taken a keen interest in the advancement of aviation, was recently treated to an interesting competition among a number of large passenger airplanes, the object of which was to determine their respective merits for regular passenger service. The main factors of the competition were the maximum of safety, of speed, of general performance, and of dependability over a protracted period of service. First of all, a series of elimination trials was conducted, only the surviving machines being permitted to take part in the final and true test in the form of a flight of 2700 miles. As for surviving machines, only one came through the elimination trials, and that was the new three-motor Farman "Goliath," which is shown in the accompanying illustration.

Under control of the well-known pilot Gonin, the Farman "Goliath" made a remarkable flight. It carried a load of over 6000 pounds. The average flying speed over the 2700-mile course was upward of 80 miles per hour, with the motors turning at 1300 revolutions per minute. The machine scored a veritably perfect performance; indeed, not even a single wire had to be adjusted upon its return, and the "Goliath" was said to be ready to undertake a new flight without a single repair or tuning up.

It will be recalled that the Farman "Goliath" as a type has been known for the past two and one-half or three years, or shortly after the termination of hostilities. However, heretofore this type has had but two motors of 250 horsepower each. The addition of a third engine should make for even greater reliability and greater speed. The two-engined "Goliaths" have distinguished themselves by the Paris-Dakar flight with seven passengers, Paris-Constantinople, and the regular commercial services between Paris and Brussels and Paris and London.



The Farman three-motor "Goliath"—the only machine to survive the rigid French tests for passenger-carrying machines

The King's Yacht "Britannia"

THIS photograph of the "Britannia" represents something which yachtesmen never expected to see again, namely, King Edward VII's famous yacht "Britannia" once more with her racing canvas spread and sailing a season's races around the British Isles. King Edward was an ardent yachtsman and owned several yachts in succession before he ordered George L. Watson to design for him an 85-foot racing cutter. The result was the "Britannia." Built in 1893, she was slightly larger, but practically a sister to the "Valkyrie," which contended for the America's Cup against "Vigilant." Her dimensions are: waterline, 87.8 feet; beam, 23.66 feet; draft, 15 feet; length overall, 121.5 feet. The "Britannia" was a great success from the first. In 1894 she took 38 races in 42 starts, and it was claimed that in her day she had won more races than any other yacht in her class, having taken over 100 first prizes.

That was a famous race between her and the American challenger, "Navahoe," for the Brenton Reef Cup, which had been taken to England by "Genesta" in 1885. It was sailed, under reefed canvas, from The Needles, Isle of Wight, to Cherbourg and back, a distance of 120 miles, and the two craft tore through the seas practically neck and neck for much of the course. "Britannia" won by 2½ seconds in a race which lasted 10 hours 37 minutes and 35 seconds. The race was protested and given to "Navahoe" because the markboat, owing to heavy weather off The Needles, had been shifted inshore.

The present King, who is a real sailorman, having served as a midshipman and risen to the rank of Captain while in active service of the Navy, is an ardent yachtsman, and he has put the old "Britannia," now nearly 30 years of age, into commission and is racing her hard in the various regattas around the English coast. The old yacht is winning her share of races and saving her time allowance against the modern 70-footers and 23-meter yachts designed by such men as Nicholson, Fyfe, Mylne and others.

In this picture the King is standing just forward of the wheel. Dead astern of the "Britannia" is one of the most modern types of racing cutters; a sloop, as we should call it, equipped with the "Marconi mast" and rigged with a main sail which is nothing more or less than the old leg-of-mutton sail of one's boyhood days. In this rig the gaff is missing and the leach of the mainsail runs, without a break, from boom end to masthead. Note should be taken of the elaborate system of strutting, characteristic of the Marconi mast. In the usual style of mast there is a single pair of spreaders at the masthead; but in these boats there are three struts, and because the mast is stayed at such short intervals, it is possible to reduce its diameter and lighten it up considerably.

The yacht "Britannia", with King George aboard

Sterilizing Eggs for Storage

BEGINNING in California and moving east, a tendency to sterilize eggs when placing them in cold storage has gathered considerable strength this year. The Poultry Producers Association of southern California will use a sterilization process on a large scale for 1920 storage eggs. Chicago egg interests, it is stated, will also adopt sterilization. The process entails an extra storage expense, but changing times justify it, and a future date when the entire storage egg industry is on a sterilization basis is not improbable.

An automatic electric machine is used for sterilization. The eggs are immersed for about five seconds in an oil solution heated to 250 degrees Fahr. The immersion sterilizes the egg and closes the pores of the shell, but is so rapid that the yolk and white are not affected and remain in the natural condition.

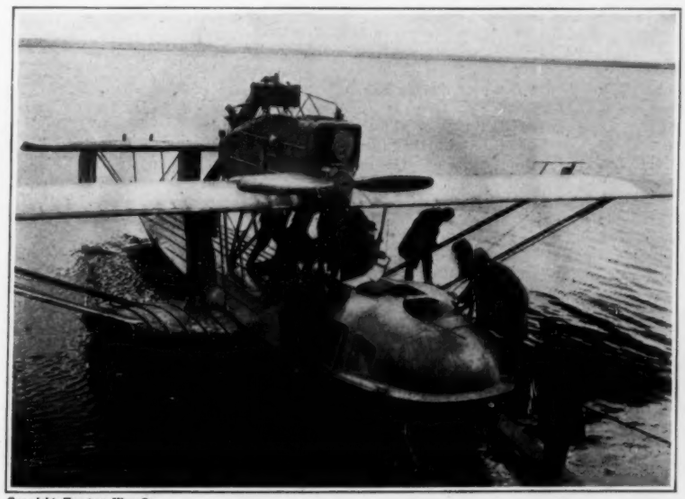
The process does not eliminate refrigeration. Sterilized eggs are placed in storage like ordinary storage eggs. They come out of storage in better shape, however, and stand long shipping to market better. On a quality basis they command a better market price than ordinary storage eggs.

The egg trade has known of the sterilization process for several years, but it is only the present season that there has been a definite serious movement to adopt it. There are several interesting reasons, but the principal one is that the egg business "is not as it was." Cold storage preservation of eggs is not perfect, and never has been, any more than many devices and methods in use are. Hitherto, however, any waste which the process involved was not out of line with general economic conditions. The past year or two in the egg trade has changed this.

The minimum initial investment in a dozen eggs put into storage has gone up and up—in 1919 the average was about 42 cents—and consequently the necessity for care of those eggs has increased also. Notwithstanding the wide popular delusion to the contrary, egg operators over a period of years have anything but a picnic. There is ample competition among themselves. It is an authenticated fact that the storage egg interests had a very unpleasant and unprofitable time handling the 1919 egg crop, and one reason was the heavy waste in storage.

Spoilage in storage eggs of the 1919 crop was the greatest in years, making an entirely unexpected percentage. Various theories in explanation were advanced, the most sensible of which was the class of labor which candled and handled the eggs just prior to storing. This labor in 1919 was inefficient, careless, in a degree not before known.

There is naturally, following the 1919 experience, much greater interest in, and appreciation of, safer storage methods. That the Poultry Producers Association of southern California has adopted the new plan is significant.



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German-built flying boat employed by the naval forces of Holland

New Flying Boat for the Dutch Navy

MORE and more the European aeronautical constructors have broken away from the conventional lines and developed machines that are truly novel. The machine shown in the accompanying illustration is a case in point. Here is a German flying boat built for Holland's naval forces. Note the comfortable, enclosed body at the bow, with the pilot's cockpit above. There are ample windows to ensure a clear field of vision. Furthermore, note the large deck to the rear of the cabin. The motors are placed in a streamlined fuselage above the single plane, and drive a tractor screw and a propeller screw. All in all, this design presents a marked departure from the usual flying boat design.

The Heavens in September, 1921

The Unidentified Celestial Object Observed from Mount Hamilton

By Prof. Henry Norris Russell, Ph.D.

AS these words are written, their author is returning from a western trip which has included visits to the four great observatories of the Pacific Coast, and some reminiscences of these suggest themselves.

Next to the memory of the hospitable welcome that is everywhere accorded to the visiting astronomer, nothing stands out more in remembrance than the beauty and variety of the situations. Each one of the four well merits a visit from the traveller, though he have no astronomical knowledge, and even if he does not enter the observatory buildings, provided only that he cares for Nature.

The Lowell Observatory, though the highest of all above the sea (7200 feet), stands on a mesa but a few hundred feet above the town of Flagstaff—an ancient lava flow, long since weathered into soil on the surface, and covered with that open forest of splendid yellow pines which is characteristic of the highest sections of the Arizona plateau. But a few miles to the northward, and in full view, rise the noble peaks of the San Francisco Mountains, more than a mile above the plain, and mantled with snow until late in the summer. Though their volcanic fires are long extinct, there are smaller craters near their base which cannot be many centuries old; and beyond them, where the plains lie lower, stretches the open desert.

Mount Wilson is indeed a contrast. The Sierra Madre, on whose outer range it lies, is a mass of granite, rising abruptly from the rich plains of the California coast, and intricately dissected by steep-walled canyons. So abrupt are the slopes that it was only with great trouble, and at no light cost, that a road wide enough for motor vehicles has been made to the top, and even on this the places where one car may pass another are carefully marked, with notes concerning the distance to the next. Looking southward from the summit the eye ranges over the wide and fertile plain, darkened for miles by orange groves, and spangled at night with the countless lights of towns and cities to the shores of the Pacific and, in clear weather, fifty miles out to sea. The mountain top itself is ample, and the various buildings and domes are scattered among the great pines, so that the newcomer, at midnight, must be on his guard lest he get lost.

Mount Hamilton is a narrow ridge, with several peaks nearly of the same height. The Lick Observatory crowns one in the center, and the houses of the inhabitants of that isolated and interesting community—which boasts of far more distinguished men of science per thousand of population than any other place in the world—are strung out along the crests on either side. Unlike the other three observatories this one is not in the woods; the coast range, in this region, is either open grass land, with scattered oak trees, or clad with dense but low and scrubby chaparral growth. In the rainless summers of California, the grassy slopes take on a tawny brown which, to the writer's eyes, is not a whit less beautiful than the dark green of forests. The rocks are softer than on the Sierra Madre, and the slopes less extreme, so that the road to the summit is wider, and has easier grades than that which ascends Mount Wilson, and which is enough to make the stoutest motorist quail when he first attempts it. (A mutual friend of Dr. Russell and the Editor, who has driven across the continent repeatedly, repented of his rashness in starting up Mount Wilson; but it was too late. There is no point between base and summit where one can turn, and he had not sufficient nerve to attempt to back down; so he had to go on to the summit.—EDITOR.) Very little can be seen of the ocean from the Lick Observatory, for it is hidden by the westernmost of the coast ranges; but the view across the foothills to San Francisco Bay and the valley which runs southward from it is of great beauty, especially at sunset, when the air fills with a ruddy violet light of extraordinary tone.

Quite unlike any of the others, and in many ways the most beautiful of all, is the view from the Dominion Observatory at Victoria. Saanich Hill, where it stands, rises but 700 feet above the sea; but it commands a prospect out of proportion to its size. North and west lie the broken and tumbled hills of Vancouver Island, covered with primitive forest, and rising to a couple of thousand feet. At their base is a little lake, of the sort which dots the hill country of New England. To the east are the Straits of Georgia—land-locked waters full of hilly islands; and to the south the twenty-mile width of the Straits of Juan de Fuca. Beyond this, in a long serrated line, rise the Olympic Mountains, in the very northwestern corner of the United States, their peaks far above timber line and the highest crowned with permanent snow. Far away in the southeast and east rise the still loftier ice-clad cones of Mount Baker and Mount Rainier.

The Mysterious Visitor

All this description of landscapes may seem to have but the slightest connection with astronomy; but if it had not been for views and sunsets a remarkable observation, which must take its place in the astronomical record of the month, would not have been made.

A little less than two weeks ago, a group of which the writer was one sat on the porch of Dr. Campbell's house at Mount Hamilton, watching the setting sun. Not all the party were astronomers; two of them, like the host's son Douglas, had returned from France with the hard-won title of aces. As the sun slowly disappeared, the astronomical members of the group, trained by long practice to the close observation of a single object in the field of view, were intent upon the singular changes in the apparent form of the setting sun, produced by atmospheric refraction. But the very life of the military aviator depends continually upon his ability to see, at a glance, *all* that may be in the sky above him, or the air beneath. So it is perhaps natural that both these officers—Captain Rickenbacker and Major Chambers—noticed a bright star, close above the setting sun. The former saw it first, as afterward appeared, but the latter was the first to remark upon its presence.

As soon as attention was called to it, everyone could easily see a brilliant yellowish point of light quite stellar in appearance, just to the left of the place where the sun had vanished, and not more than two degrees above the horizon. Within five minutes it had set, or at least had disappeared into a low-lying bank of haze; but not before Dr. Campbell had observed it with binoculars and found it to be still stellar in appearance.

Conversation brought it out that Captain Rickenbacker had seen the object while the sun was still entirely above the horizon, at a distance of about six diameters from the sun. This made it clear that it must have been a celestial object, for it had evidently followed the setting sun downward before it had been lost to sight.

It was obvious at once that this was no common object. To be visible before sunset, at so low an altitude, and in a sky which for that climate was not very clear, the thing must have been a good deal brighter than Venus—and Venus was far away on the opposite side of the sun. A glance at the Ephemeris showed that no other planet was in this region.

What was it, then? A new star? Not likely, for it was far from the Milky Way, where most of the Novæ have appeared; and besides, it was brighter than any Nova on record, except perhaps Tycho Brahe's. A comet? This looked more reasonable, for there are a number of instances on record in which comets, at perihelion, close to the sun, have been visible in broad daylight, the last cases being as recent as 1882 and 1910.

An account of the observation was telegraphed to Harvard, the center for the dissemination of such news on this continent, and thence sent broadcast. Careful search at Mount Hamilton the next morning, with field glasses and telescopes, however, revealed nothing; and up till last Monday, eight days later, no further news of the suspected comet had come in.

This does not mean, however, that there was any illusion about the original observation. It is entirely possible for a comet's orbit to be so situated that it may approach the sun from behind, for a terrestrial observer, in such a way that there may be no chance of seeing it upon a dark sky, and so detecting it by the ordinary methods of search. If the comet came from the southern part of the celestial sphere, and had a small perihelion distance it might never be visible to northern observers at all, except in daylight, when close to the sun. It may be recalled that the great comet of 1882 was first seen at Rio de Janeiro, but owing to defective cable communication news did not reach the northern hemisphere until after it had passed perihelion, and been discovered by numerous observers in broad daylight. Again, the daylight comet of 1910 was first seen by workmen on a railway in South Africa, who supposed it to be Halley's Comet; and only the accident that a reporter for a local paper wrote a paragraph about it brought it to the attention of the astronomers of the Transvaal Observatory.

There is reason to hope, therefore, that we may yet receive news from some southern point which may enable us to say more than is at present known concerning this strange visitor to our skies.

At 11 o'clock: Sept. 6.
At 10½ o'clock: Sept. 14.
At 10 o'clock: Sept. 21.
At 9½ o'clock: Sept. 30.
At 9 o'clock: Oct. 7.
At 8½ o'clock: Oct. 15.
At 8 o'clock: Oct. 22.

The hours given are in Standard Time. When local summer time is in effect, they must be made one hour later: 12 o'clock on September 6, etc.

NIGHT SKY: SEPTEMBER AND OCTOBER

The Heavens

Turning to the unchanging stars, and watching the heavens at the hour of observation indicated on our map, we find the Milky Way in a huge arch spanning the heavens. Where it disappears in the southwest is Sagittarius, just setting. Then, above the great star-clouds, Aquila, and almost overhead, the great cross of Cygnus. Beyond this, descending toward the northeast, we reach Cepheus and then Cassiopeia. Perseus comes next, and finally Auriga, which has just risen.

The Great Bear is low on the northern horizon, with the Little Bear and Draco above it. Hercules and Corona Borealis are well down in the west, and Lyra higher up. The southern sky is dull, its only bright stars being Fomalhaut, low in the south, and Beta Ceti

(*Continued on page 175*)

Our Latest Dreadnought, the "Tennessee"

THE lower photograph of our latest battleship, the "Tennessee," was taken from off her starboard bow, when she was undergoing her full speed trials, recently, off Rockland, Maine. This fine ship, it will be remembered, is driven through electrical reduction gear. In the trial she comfortably achieved her contract speed of 21 knots.

The photograph is of interest as showing, better than any we have seen, the way in which that portion of a modern battleship which has to do with the navigation and the fighting of a ship, has grown up step by step to its present remarkable bulk and height. The freeboard, forward, to the level of the forecastle deck must be about 25 feet on this ship, at her mean draft; and if so, the officers at the range-finder on the roof of the pilot house must be about 75 feet above the water. Most of the tall foremast is obscured by this massive superstructure, so that there is a clear view of the mast for not much over 15 feet before we come to another fighting station, or series of fighting stations, which takes the place of the old fighting top. Here we have an enclosed fire-control position for the secondary battery, now known as the torpedo-defense battery; another such station for the fire-control of the main batteries; and above that is a third position, glass-enclosed, which gives an all-round view.

It will be noticed that the top of the mainmast carries a duplicate construction to this. The disk on the front of the foremast is for showing the range at which the "Tennessee" is engaged; such information being given for the benefit of other ships in the fighting line.

Another interesting feature revealed by this picture is the great length of the principal range-finders, of which one is carried in each turret, in the angle formed by the roof of the turret and its rear wall. In our latest ships immediately preceding the "Tennessee," these range-finders extended from side wall to side wall, with their object glasses projecting just beyond the turrets. In the "Tennessee," apparently the range-finders have been still further lengthened, and there is a projection of some 8 or 10 feet beyond the turret on each side. Length means accuracy of finding, and with range-finders of the size here shown, provided we are getting the best optical glass, it should be possible to give instantaneous readings of the range to the enemy with a very small percentage of inaccuracy, even at extreme ranges.

Fine ship though the "Tennessee" is, she will be the last of her class; for in the "Maryland" and her three sisters, the twelve 14-inch guns will give place to eight 16-inch. The 16-inch is a vastly more powerful piece; but at the same time the "Tennessee," with her twelve pieces and with equal gunnery would, in competition, put 50 per cent more shells through the target than the "Maryland" with one-third per cent less guns.

Six of the twelve 14-in. 50-caliber guns, which form the main battery of the battleship "Tennessee"

Automatic Barn Cleaning

IT is sometimes erroneously assumed that because labor-saving farm machines and appliances are very numerous the field is getting close to maximum development. A disagreeable, laborious job in thousands of dairy barns gives the denial to this assumption. We have reference to the daily removal of manure, a heavy abominated chore. It is true that litter and manure carriers, now installed in many barns, are a decided advance over the wheelbarrow, but the overhead carrier doesn't solve the problem, for even with carriers there is a lot of heavy, time-consuming manure-forking.

The need is for some mechanical arrangement which will eliminate this expensive hand-work, automatically removing the manure. The problem is simplified somewhat from the fact that gutters to receive manure are commonly built into the barn floor behind the cows. It would seem a practical matter to develop a device which would clean these gutters mechanically, obviating the hand-forking now required.

As a matter of fact, in a very few isolated cases, ingenious dairy farmers have home-made mechanical cleaners now in successful operation at this job. An Ontario man's plan is adapted to his 100-foot barn. Two drums or rollers, one at the inside end of the manure gutter, the other at the outside end, where a manure spreader receives the transported manure, operate, in conjunction with a 2-horsepower gasoline engine, a chain and wooden cross-piece arrangement which travels along the manure gutter carrying the manure with it. The wooden cross-pieces are a trifle narrower than the gutter, so that they move smoothly, yet catch all the manure.

As the chain travels outward with the manure, emptying it, the chain winds up on the outside roller. It is allowed to dry well, then by a reversing process which unmeshes one set of gears and meshes the other the roller at the inside end draws the chain and the entire cleaner back into place.

This farmer has successfully cleaned his gutters mechanically for six years. The cost of the equipment, put together out of odds and ends, was very reasonable, while for power he already had an engine used for other barn chores.

This farmer thought for years that he possessed the only barn-cleaner in existence—until he heard of another Ontario man who had attacked the same problem, solving it in a different way. This second farmer used the chain and cross-piece idea, but had the chain travel like a belt, that is, it passed along the gutter, emptied through the barn wall, and returned beneath the gutter, where the barn construction gave it room to move. In both cases there were details that gave trouble at first, but the men worked them out. Adoption of similar arrangement in dairy barns the continent over would mean an enormous aggregate saving in labor.

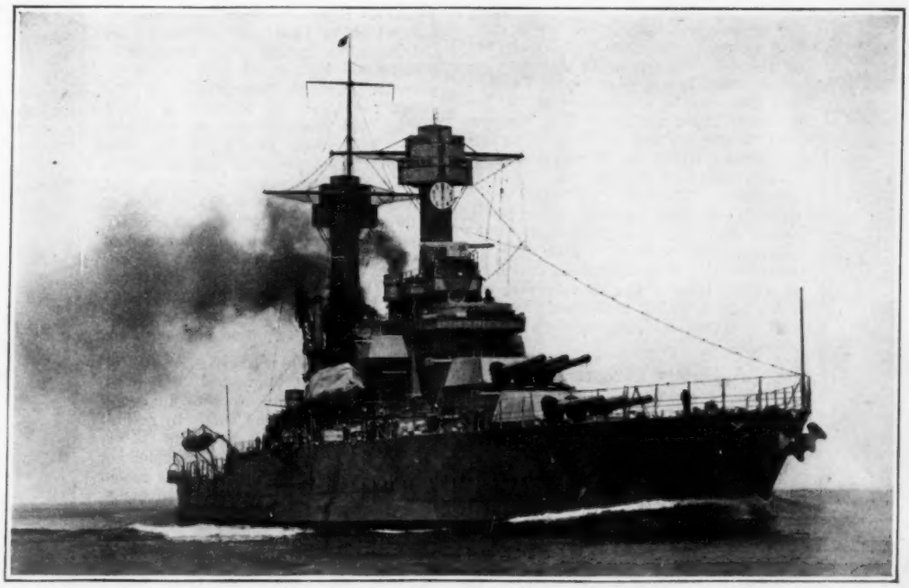
Railroad Steel Tie Plates Rust Less with Copper in Them

THE New York Central lines have conducted a series of tests to determine the relative loss of metal in tie plates of various compositions, including those containing a small percentage of copper. The length of time over which the tests were conducted varied from two years to a maximum of six years, and some of the tests are still in progress. In all cases the maximum corrosion developed on the bottom or under side of the plates, contrary to the generally accepted theory of most engineers and maintenance of way men that the maximum corrosion takes place on the top or exposed portion.

The percentage of copper in the plates containing that metal ranged between 0.25 per cent as a minmum and 0.5 per cent as a maximum, the plates so treated being rolled otherwise, according to the standards of the New York Central. The copper-treated plates so obtained were subjected to the same tests as the other plates. An exposed test on a number of steel tie plates rolled from mild Bessemer steel containing 0.25 per cent copper and a number rolled according to the same specifications without the copper content showed an average loss of 8.88 per cent for untreated plates and only 1.46 per cent for the treated plates.

A second exposed test was made which covered a larger number of tie plates rolled from metals of various compositions. The plates used in this instance were cleaned and then exposed on the roof of a building at Hoboken, N. J., where the action of the salt air of New York Bay could be studied. Tests showed loss on the copper plates from 0.46 to 0.72 per cent, averaging 0.56 per cent.

In comparing the data so obtained the nearest approach to the results reported from the copper-treated plates was a loss of 0.59 per cent for high carbon open-hearth steel, too hard to punch. The pure iron plate came next, with 1.17 per cent, and then the high-carbon Bessemer plate, with 1.77 per cent, the latter also being too hard to punch. The remainder, which were standard steel tie plates, varied from 4.70 to 6.60 per cent, showing for common or regularly accepted tie plates 8 to 10 times the loss for the special copper-treated ones.

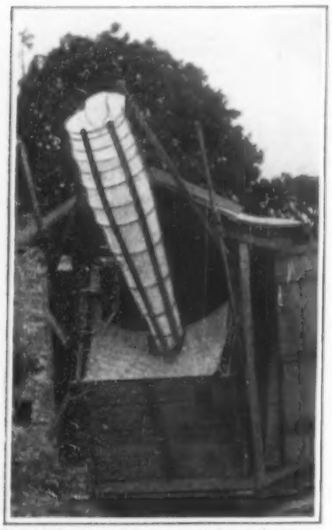


Note the large rangefinders projecting through sides of turrets; also the lofty bridge structures at the foremast, and the two-deck, enclosed, fire-control stations at top of both masts

Battleship "Tennessee" making 21 knots on her trials

Inventions New and Interesting

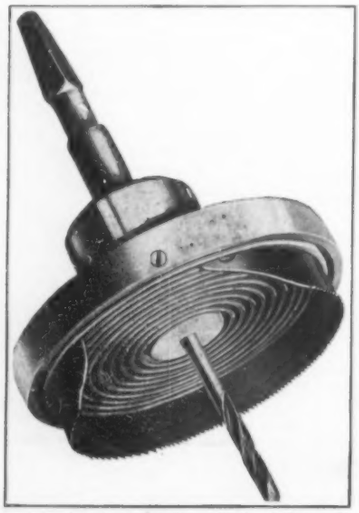
A Department Devoted to Pioneer Work in the Arts



Revolving cabinet, with telescope, that makes sun baths available in the higher latitudes

Revolving Sun Baths

THAT the rays of the sun can be used for curing many skin diseases and that the sun baths are advantageous even to those who are in perfect health has long been well known to the general public. But how is this most beneficial agency which Nature has placed at our disposal to be utilized in northern countries where the hours of sunshine are few? That is a problem which a Brittany doctor, M. J. de Thezac, has tackled and, as will be seen from the accompanying photograph, successfully solved. His invention consists of a most ingenious revolving cabin, combined with a telescopic arrangement, bearing a huge lens for concentrating the rays on to any part of a patient's body. This installation, which has just been tested in the neighborhood of Quimper, enables the sun's movements to be followed with ease. Moreover, it is so constructed that the patient, having closed the door of the cabin, is shielded from inquisitive eyes. This most singular looking device has created quite a sensation in French medical circles as well as in the locality of Quimper. It is as novel as it is simple.

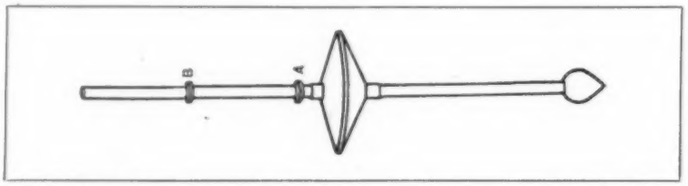


One circular saw for all the holes, of whatever size

Apparatus for Testing Tar

THE apparatus illustrated affords a simple and reliable means of testing the viscosity and consistency of tars according to a British journal. Obviously, liquid fuel, to serve its most useful purpose, must be sufficiently fluid to flow by gravitation at normal temperatures. These conditions are readily met by 50 per cent mixtures of pitch and oil, though it is by no means unusual to see so-called 50 per cent mixtures which have to be shoveled out of the barrel. This is not a question of temperature, because as a matter of fact the mixture is not so adversely affected by a comparatively low temperature as is pure tar, as was evidenced in a 50 per cent mixture at the Greenwich Tar Works of the South Metropolitan Gas Company, London, England, which at a temperature of 55 degrees Fahrenheit was decidedly more fluid than an average tar at 60 degrees.

It has been suggested that the standard should be specific gravity rather than percentage of mixture; such a standard, however, could not be universally applied owing to the variations in the makes of tar. Thus, while the specific gravity might be the same, the actual consistency (the all important factor) might vary considerably. The exact percentage of the mixture need not be seriously considered, as the calorific values of the pitch and oil are approximately the same. It therefore resolves itself into a question of fluidity, and this may be determined by the instrument under notice. It is first necessary to prepare the mixture of highest consistency which can be profitably employed, and then have it tested by the instrument. The test is made in a cylindrical vessel, the material to be tested being at 77 degrees Fahrenheit. The instrument is allowed to sink into the mixture, the time occupied in sinking by that portion of the stem between the two rings A and B indicating the properties of the mixture as regards consistency.



To test the consistency of tars (the apparatus is shown on its side)

A Handy Circular Saw

THE mechanic who is obliged in the course of his day's work to cut out, from metal blocks or sheets, any considerable number of holes, will testify to the utility of the instrument shown here. It was originally designed, we are given to understand, by an automobile repair man who was frequently called upon to put new speedometers and other instruments in old instrument boards. The drill is started at the center of the hole-to-be, and after it gets well into the metal, the saw comes along in its trail and takes hold of its end of the job. The hole is cut, of the desired size, in a jiffy. A single chuck and blade are sufficient for drilling and sawing holes of a wide variety of size. The blade can be placed in any circular groove for desired size.

An Alarm for the Sleeping Fisherman

LABOR-SAVING devices whereby the fisherman may be relieved of constant watch of the cork as he seeks to ensnare the finny tribe are not uncommon, but the use of an umbrella rib and a sleigh bell as a warning signal of a "catch" is an ingenious contraption rigged up by a colored man fishing on the Potomac River, near Washington, D. C.

A discarded umbrella rib, to which is attached a sleigh bell, is stuck perpendicularly in the bank. When a fish nibbles the bell sounds the alarm and the disciple of Izaak Walton is ready to land the easily beguiled member of the finny tribe. The attendant of the hook-and-line can go to sleep on the bank, feeling confident that when the sleigh bell tingles there is a perch or catfish on the other end of the line waiting to be landed.

A linen line is fastened to the end of the umbrella rib, while the sleigh bell is tied near the top of the rib. As the fish nibbles, the rib easily bends and the alarm is given. The darky claims for his invention a contribution to the campaign to reduce the cost of living.

Chicago City Engineer Favors Trailers

LATE reports show that amendments to the traffic ordinance in Chicago have been drafted for submission to the city council with a view to preventing rapid destruction of the street pavements by excessively heavy traffic. The proposed changes were discussed at a recent meeting in the office of the city engineer. It is proposed to change the gross weight of vehicle and load from 40,000 pounds, as at present allowed, to 30,000 pounds, with a maximum weight of 1,000 pounds per inch of tire width, but it was agreed at the meeting that the combination of a truck and semi-trailer with load should be allowed a weight of 32,000 pounds, with a limit of 24,000 pounds on any one axle.

United States Patents Abroad

UNDER the Nolan bill, the privilege of our inventors to file applications abroad, covering inventions where the rights of priority had not expired August 1, 1914, ends September 3rd. After that date no valuable patent rights accruing to American inventors during the war can procure foreign protection.

The Paper Suit

SOME time ago, when there was a good deal of excitement about paper suits and the possibility of their putting the woolen trade out of business, a Brooklyn tailor undertook to satisfy himself as to what there was in it. He got hold of some heavy wrapping paper and made him up a suit. The material did not look to his practiced eyes suitable for needle and thread, so he used the paste brush. The result is the suit of our picture. It was actually worn about the streets of Brooklyn for a day without calamity of any sort and without attracting very much attention. But it was not a rainy day.

However, as we have learned since, this is not the sort of garment that Germany threatened to send over here and sell for sixty cents per suit. From its appearance we do not think that many Americans would have been satisfied with it, even if it was American made. The German paper suits are made of paper yarn that is woven into a coarse fabric, and come pretty close to our American ideas of cheap but wearable clothes, although too heavy for comfort.

When the fish nibbles, he rings the bell and the sleeping fisherman wakes

Even though it is of paper and only pasted together, it held for a day

Water Supply of the Panama Canal

(*Continued from page 157*)

mated that it takes about seven and a half million cubic feet to make a complete lockage. This represents the amount of water drawn from Gatun Lake in lifting a vessel 85 feet through the three locks at Gatun and then lowering it down 85 feet to sea-level through the locks at Pedro Miguel and Miraflores. Hence it can be figured that the storage of approximately 10 billion cubic feet of water will provide for 1240 lockages. During the entire calendar year 1920 (the amount of traffic was the largest in any previous twelve month period), when over 3000 vessels passed through the canal, the total number of lockages was 2831. The difference in number of ships as compared to lockages is due to the fact that with two ships in a lock chamber at the same time, but one expenditure of water is necessary. During the passage of the Pacific Fleet as many as six destroyers lashed together were passed through the locks at one time. Experience has shown that with ordinary luck in the arrival of large and small vessels, 24 lockages may be equivalent to 30 ships.

Floating, lifting and lowering ships are not the only uses made of water at the Panama Canal. More than twice the amount of water required for lockages during the calendar year 1920 was used by the hydroelectric plant, located beside the spillway at Gatun, in the generation of electric power for the operation of the locks, the marine shops, dry docks, and other auxiliaries and for lighting the entire Canal Zone. It will always take at least twice as much water for the hydroelectric plant as is used for lockages even when the canal is operated at full capacity. During the calendar year 1920 the hydroelectric plant used over 44 billion cubic feet of water, which represented 26 per cent of the inflow consumed. However, in case of an acute shortage of water there is a steam power plant at Miraflores which burns oil and can be kept at two-thirds the capacity of the hydroelectric plant at Gatun. Of course, the production of power at the Miraflores plant is very much more expensive than at Gatun.

The following table shows the consumption of water from the lake during the calendar year 1920, giving the way the water was used, the amount and per cent used in each instance:

Water Consumption, Gatun Lake, 1920

Cause	Billion cu. ft.	Per cent of inflow
Spillway waste	81.00	47
Hydroelectric power	44.42	26
Evaporation	22.40	13
Lockages	20.86	12
Leakages and miscellaneous	2.46	1.8
Increased storage	.40	.2
Total	171.54	100.0

It is considered that the minimum level for convenient operation of the Panama Canal is to have the lake surface 80 feet above mean sea-level, which maintains 40 feet of water in Gaillard Cut. However, as about 95 per cent of the ships using the canal draw less than 30 feet of water, there is a wide margin for practical operation. Should the water level by any chance drop to a point reducing the depth in the cut to 30 feet only ships drawing in excess of that depth would be prevented from making passage, representing but 5 per cent of the present traffic.

The space between the convenient minimum of 80 feet above sea-level and the maximum storage level of 87 feet, provides almost 32 billion cubic feet of water for consumption during the dry season, the only time when there is any danger of a shortage. It has been calculated that this will provide, along with the consumption of water for the present hydroelectric plant and municipal purposes, enough water to handle 1925 lockages, or approximately sixteen lockages a day for the average dry season. This will care for more than twice the present traffic of the canal, hence it can be seen that there is no imminent danger of the Panama Canal going dry, or the water supply being so reduced as to interfere with the operation of that great highway of commerce. However, should the water supply become insufficient two projects for increasing it enough to operate the canal at maximum capacity are now being studied.

Our "ZR-2" Airship and Its Shed

(*Continued from page 160*)

Considerable difficulty was experienced in designing the detail of the crossing of this conduit with the door tracks. It was necessary to provide some closure of the slot during the passage of the door trucks because of the shock to so large and heavy a structure by jolting over this opening. A plan was perfected so that at each crossing of the rail with the slot a moving rail has been installed which can be thrown by interlocking connecting rods, tying together all of the crossing. When the doors are not in use, this rail leaves the slot open for the passage of the trolley, guys and line to the airship. When the door is about to be moved, the connecting rod is thrown and the rails move up to fill up the slot opening and provide a continuous track for the door.

The doors are mounted on standard gage trucks which travel on two lines of track laid on concrete bases. They are driven by electric motors with the power transmitted through a plow which collects current from conductors in a slot. This slot, or conduit, however, only approaches the outer edge of the door, so as to avoid possible fire risks of an electric conductor near the open door of the hangar. In addition to the electric drive, an emergency winch with cables for hand operation is provided to open and close the doors in case the current or motor should fail.

Special attention had to be devoted to the lighting of the hangar because of the possible presence of explosive mixtures due to the escape of hydrogen from the dirigibles. No wires or exposed connections are ever introduced inside the huge shed. All lighting is provided through heavy glass gas-proof covers in the walls, floor and roof with the connections outside the structure. On account of the gas which is used to fill the balloons, actinic glass is used in the skylights as it cuts out all the detrimental rays. Special provisions for working in the hangar are provided by a number of catwalks, or horizontal balconies running along under the roof. Fastenings for traveling hoists are provided along the roof rafters.

Utilizing Tomato Waste

(*Continued from page 161*)

Indianapolis, the hub of the middle western tomato pulping industry, the cost is estimated to be $80,000. To assemble the 2500 tons of wet seed alone, the charge would be $16,800. If the seed are shipped to the central plant, they are merely washed, pressed to eliminate excess water, and dried in rotary driers. If the entire waste is consigned to the central plant, the seed must be separated and the two lots of seed and skins dried separately.

Under the plans of the producer separating the seed from the remainder of the waste at each pulping station, the brevity of the tomato-pulping season (August 1 to October 15) is taken into consideration. The assumption is that the plant will be of only sufficient capacity to dry the peak load, pressing the seed during the winter months. About 2200 tons of dry seed will be accessible. Assuming the "union" working day of an expeller as being 8 hours, with a capacity of 500 pounds an hour one expeller will crush 2 tons a day. Figuring only 200 working days, and one expeller handling 400 tons, six expellers would be adequate for accomplishing the job. An allowance of $9 a ton of raw material is made for drying and handling from the cars to storage bins preparatory to expelling, while $15 a ton of dry seed is reckoned as the cost for extracting the oil and handling from the seed storage to the oil in tanks. Overhead and management charges are included in this computation.

Oils extracted by these prescribed methods have been pronounced as of excellent quality. Feeding tests with animals have determined the nutritive value of the residue. The scientist also determined the value of the Cobwell system of grease recovery from garbage. Involving only a single handling, yielding the finished fertilizer and crude oil simultaneously, such a system has the advantage of leaving the plant unencumbered for operation in the manufacture of other products during the remainder of the year. Based on a large scale operation of existing plants, a charge of $4.75 a ton of raw material is allowed. The proceeds from fabricated tomato cyclone waste are computed by Doctor Schraeder to be $116,000 while the expense would be $118,000, rendering the utilization of the whole waste as a foolish undertaking. However, if the seed alone are shipped in, the profit to be derived from drying and expelling is approximately $54,000. This profit is realized by figuring expelled oil at fourteen cents a pound, solvent oil at thirteen cents a pound, press cake at $40 a ton, and dry skins at $10 a ton.

The manufacturers of tomato products in the United States might profit by the example of Italy—premier tomato-producing country—in the utilization of seeds and skins. The province of Parma uses 83,660 tons of tomatoes annually, this volume yielding from 11,000 to 12,000 tons of skins and seed, containing 80 per cent moisture. Upon removal of the water there is a residue of between 3000 and 4000 tons, of which about two-thirds is seeds. The possibility of recovering 500 tons of oil from waste seeds is not a far-fetched supposition when it is stated that these seeds when extracted by pressure, yield 18 per cent of oil and by solvents 20 per cent. Tomato-seed oil has a heating value on a parity with that of olive oil, and because of its drying properties is useful in soap making.

Various methods of extracting the oil from the seeds are in vogue in Italy. One chemist suggests a way of divorcing the seeds from the skins by agitating the material with water and permitting it to settle, the seed descending to the bottom.

Experiments conducted by the Office of Home Economics, U. S. Department of Agriculture, indicate that the digestibility of tomato-seed oil compares quite favorably with that of olive, almond, peanut, cocoanut, walnut, and brazil nut oils. When refined the tomato product can be used for culinary purposes, proving satisfactory as a salad oil. Tests showed that 16 days elapsed before the oil assumed a soft and sticky film, the experiments being conducted to ascertain its drying properties. The process could doubtless be hastened by the addition of driers to the oil; anyway, the scientists are inclined to attach certain merit to the oil as an ingredient of paints and varnishes.

The residue after extracting the oil from the seed is classified as tomato-seed meal, ranking in protein content with cotton-seed meal, sunflower seedcake, sesame-oil cake, rape seedcake and linseed meal. With respect to moisture and ash content, the product obtains a rank alongside other feedstuffs. Italy has likewise established the worth of the meal as a feed for cattle, a factory being in operation near Naples for the industrial manufacture of tomato seedcake. Feeding trials are convincing that tomato seedcake is of equal food value to linseed cake in the maintenance of milk cows. Similar investigations of comparing tomato seedcake with flaxseed cake gave the edge to the former as being richer in protein and fat.

Complete utilization of the vast accumulation of tomato seeds in the United States in producing oil would also yield a by-product of 1200 tons of meal. Also supplementary to this volume of meal there would be available 1800 tons of tomato skins. Duplicate the example of Italy—incorporating the dried skins with the meal—and you have enhanced the total volume to approximately 3000 tons.

Fortunately, the accumulation of tomato waste is concentrated in Indiana, Iowa, Michigan, and Ohio in the Middle West, and New Jersey, Pennsylvania, New York, Delaware, and Maryland in the East—a condition that logically invites the location of a reducing plant in each of the two principal sections. This would facilitate the assembling of the crude material at a minimum expense, while a co-operative plan of manufacture would doubtless give a stable foundation to the industry.

The Motor Clipper

(*Continued from page 162*)

the big "France" of 7000 tons, built in 1912 and considered the largest auxiliary vessel afloat. Her entire twin screw machinery has been taken away, because it was much too expensive and spoilt the speed of the ship under sail. This is a most significant fact. "France" is a square-rigged ship, which of course made the matter still worse; but even a twin-screw schooner is not much better off.

Some shipowners now go so far as to do away with machinery entirely for the propulsion of sailing ships, and for their handling as well. Of course, if no reduction in the number of crew is allowed, there is no object in installing costly deck and rigging machinery in the form of winches, etc. For propulsion, at present, one has the choice of the common single screw (two-bladed of course) hydraulic propulsion, and the aerial propeller. The last is of course ideal for propulsion of a sailing ship in calms, and as a 12-foot screw can easily absorb 100 horsepower, with an aerial motor installed on deck, this might be the ultimate solution of the problem. Only actual experience can show which is the best. But because the sailing ship is helpless in calms, and calms cost money, some kind of "all work" propulsive machinery must be used where the entire outfit, or a part of it, can be used for every purpose on board requiring power. The many different auxiliaries to the main engines now used on motor ships, not only cost a good deal of money, but being little used, are sure to be neglected, and can certainly be left out in a sailing ship. Only thus can power be made to pay nowadays. And it is surprising how little power is needed to move a big ship at 5-6 knots.

As already stated, a successful sailing ship must also have an easy form of hull and great stability, two qualities that are contrary to each other. In sailing yachts this is evaded by using a deep ballast keel below the hull; the keel serving the double purpose of leeway-stopper and stabilizer. In the "Motor Clipper" artificial stability is secured by automatic ballast tanks, which empty to leeward and are kept full to windward as required, but in heavy winds only. The very simple means used cannot yet be disclosed (patents pending), and except in tacking, very little if any pumping is required; nevertheless, the stability of the vessel is more than doubled.

As regards the form of the hull, in the "Motor Clipper" full advantage is taken of the writer's discovery of the natural shape of the water hollow in closing behind a vessel. Although the bow wave cannot be overcome, and does show in the photograph of the model, the entire absence of a visible wake proves that the

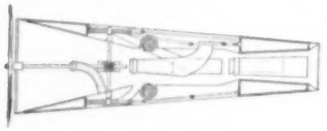
(*Continued on page 173*)

Recently Patented Inventions

Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

Pertaining to Aeronautics

AIRPLANE.—G. C. OFFEN, Box 752, Moose Jaw, Saskatchewan, Canada. An object of the invention is to provide means for facilitating the propulsion of airships of any type, and at the same time conserve the motor fluid. A further object is to provide means for utiliz-



A PLAN SECTION

ing the movement of the air to induce a suction or partial vacuum to assist or transmit motion to the propelling means the air current passing rearwardly to the propeller of the machine.

Pertaining to Apparel

UNION GARMENT.—L. T. DWYER, Fairfield, Ill. The invention relates to apparel for boys and girls; its object is to provide an undergarment arranged to give the user the desired freedom in movement of body without danger of unduly straining or tearing the garment. Another object is to prevent the user's body from being exposed at the usual side openings while the garment is worn.

SOFT COLLAR HOLDER.—J. O'CONNOR, 437 W. 43rd St., New York, N. Y. The present invention is in part a specific form of the invention forming the subject matter of United States Patent No. 1369703, granted to the same inventor February 22, 1921; the present invention includes a novel means for adjusting the relation of the upper and lower sections of a two-part collar holder.

GARTER.—LILLIAN G. WARREN, Box 35, Westwood, Cal. The invention relates to a garter arranged to hold the hose securely in place without danger of unduly binding on the user's leg or interfering with the blood circulation. Another object is to provide convenient means for safely storing money, jewelry or other articles; the device may be quickly placed in position or removed from the leg.

GARMENT.—ANNE C. BERRY, 35 Rowan St., Winfield, L. I., N. Y. The object of the invention is to provide an outer or undergarment having legs, such as rompers, bloomers, drawers, combination chemise and drawers and the like, whereby the desired comfort to the wearer is insured, and the wearer can readily exercise the lower limbs in walking, running or jumping without being unduly hindered.

Electrical Devices

PORTABLE ELECTRIC SAW. — D. C. LANGE, 700 W. Atlantic Ave., Audubon, N. Y. An object of the invention is to provide a light, portable electric saw suitable for use when actuated by an electric current with a great saving of time and labor in that an operator may carry it by hand from place to place, and use it as readily and as accurately as a hand saw in performing different grades of work more rapidly and with less physical exertion; movable guard members are provided to preclude danger to the operator.

BATTERY JAR.—O. WITTMANN, 207 S. 11th St., Lincoln, Neb. The invention relates to battery jars used in connection with automotive vehicles, wherein the plates, and often the cells, themselves, become cracked, due to the excessive vibration. An object of the invention is to provide a battery jar particularly adapted for use in connection with automotive vehicles or other adaptations in which it is submitted to extreme vibration.

HOLDER FOR INCANDESCENT LIGHTS.—W. A. RAYMOND, South Bend, Wash. This invention relates to holders for incandescent lights adapted to be used in locomotive headlights, for instance, in place of a carbon ejector, so that the light will be supported at the focus of the reflector. With this device no change is required in the construction of the headlight, and it is not necessary to interfere with the reflector nor its mounting.

Of Interest to Farmers

TRACTOR ATTACHMENT.—J. F. SCHUBLE, address W. B. Paton, Cashmere, Wash. The invention particularly relates to an attachment for tractors which are adapted to pull plows, ditch diggers, cultivators, etc. An object is to provide a means for lifting the plow or digger off the ground when they are not in use, and to provide hand-operative means on the tractor for controlling the position of the plow.

Of General Interest

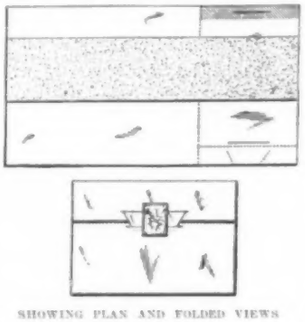
CABINET.—LILLIE C. DIMICK, 1656 Howell St., Fort Wayne, Ind. The invention relates more particularly to a combination cabinet including an ironing table, pressing board, and clothes rack, the object being to place all of the needed assistance in ironing immediately at hand, and eliminate all waste energy by saving steps. A further object is to provide a cabinet when closed, which presents the appearance of and constitutes a practical work table for the kitchen.

SMOKING PIPE CLEANER.—E. C. GUNNARSON, 304 Van Brunt St., Brooklyn, N. Y. Among the objects of the invention is to provide a cleaning member preferably in the nature of a piece of wire, or its equivalent, of a permanent nature and sufficient length for cleaning a pipe stem. The wire being adapted to be easily carried in coiled form within a circular holder in a vest pocket, a head or enlargement at one end of the wire being provided for all the manipulations.

DOMESTIC REFRIGERATING APPARATUS.—R. M. BLAKELY, 35 N. 18th St., East Orange, N. J. This invention has for its object to provide a simple compact and efficient arrangement which is particularly adaptable for apparatus of small capacity. Another object is to provide a refrigerating apparatus in which moist air is utilized as a cooling medium for condensing the vapors of the refrigerating medium.

COLLAPSIBLE CRATE OR PACKING CASE.—C. F. RAINSFORD, 28 Fullarton Rd., Parkside, South Australia, Australia. The invention has been designed for packing, shipping and transporting goods, being so constructed that when empty, it can be collapsed or folded down into a small space, thereby reducing the space required and consequent cost, and the liability to breakage. When erected the parts interlock and hold one another firm.

STATIONARY.—A. CALCANO, La Guaira, Venezuela. This invention relates to a device which does away with separate envelopes and letterheads, and has for its object to provide



SHOWING PLAN AND FOLDED VIEWS

a combined envelope and inclosure formed from a single blank having lines of partial separation and lines of adhesive for permitting the sheet to be folded into a letter and an envelop for the letter.

MASSAGE DEVICE.—J. O. LINDEN, c/o St. Joseph's Sanitarium, Albuquerque, N. M. An object of the invention is to provide a massage device which is hollow and which may contain a heating or cooling agent to give to the surfaces of the massage device the desired temperature. A further object is to provide a shape of device which facilitates various massaging operations.

TRAP.—H. W. JUSTUS, Napanoch, N. Y. An object of the invention is to provide a construction of trap automatically controlled by a float in the trap and adapted to force the water to a tank at a higher elevation or return the same to the boiler. A further object is to provide an arrangement of diaphragm and means operated thereby for controlling the flow of water from the trap through the medium of live steam admitted to the trap to exert a pressure on the water.

PROCESS FOR THE PRODUCTION OF A CRYSTALLIZED ESTER OF THE STEARO-RICINATE-DUODID.—F. BOEDECKER, Britz, near Berlin, Prussia, Germany. This process for the production of a crystalline ester is characterized in that first iodin in the presence of aqueous acetic acid is added to the stearoricinate and the latter then transferred to the ethyl-ester.

FOLDING BED.—J. I. HIGGINS, East Rockaway, L. I., N. Y. The present invention relates to a folding bed of the mantel type which is arranged to be raised to a vertical position against a wall so as to occupy a minimum amount of floor space, and also to provide a shelf for supporting ornamental or other articles.

HEAD FRAME FOR SUPPORTING EYEGLASSES.—F. W. HAVILAND, 540 Manhattan Ave., New York, N. Y. An object of this invention is to provide frames for eyeglasses in which the weight of the glasses will be taken from the bridge of the nose and supported by other parts of the head, such as the forehead or cheeks. The device comprises an adjustable frame for supporting the lenses, and means for supporting the glasses from the head.

UMBRELLA COVER.—I. H. WEINBERG and C. F. BISBING, 23 E. 21st St., New York, N. Y. It is the purpose of this invention to so construct a cover as to permit of a certain amount of stretching so that the cover can be easily drawn over a rolled umbrella and will snugly fit around the same to provide a neat and ornamental addition and one which will prevent injury to the threads of the umbrella.

VANITY BOX.—A. VERICEL, 315 W. 136th St., New York, N. Y. The invention relates more particularly to that type of toilet case adapted to be carried in hand bags, satchels or the like. The primary object is to provide a device of this character in which powder receptacles are employed, the puffs by which the powders are applied serving as a means for retaining the powders in place within the receptacles.

CUP.—R. JENNINGS, La Grange, Mo. An object of the invention is to provide a device adapted to hold a liquid so that a person may drink therefrom while in a reclining or recumbent position without inconvenience or without spilling the liquid. A further object is to provide a device that has means operable to prevent the flow of a liquid therefrom.

SELF-SERVICE STORE.—A. W. B. JOHNSON, address R. L. Johnston, Am. Trust Bldg., Birmingham, Ala. The invention has for its object to provide a self-serving store with a plurality of compartments for the display and sale of separate lines of stock, the compartments having corner, wrapping, checking and paying stations so that the clerk on duty may be in close proximity to the customers, at the same time watch the entrances and exits.

STADIA ROD.—E. H. SCHWIER, Box 233, Huntington, N. Y. This invention relates to surveying instruments and has reference to a stadia rod provided with graduations consisting of unit measuring figures, each of which is placed at an angle to the axis of said rod. An object is to provide a form of graduation for a stadia rod which will be simple and free from complications tending to confuse or delay the transit man.

RUG.—E. HEIDENHEIM, 43 Leonard St., c/o Pioneer Rug Co., New York, N. Y. It is an object of the invention to provide a method for the production of rugs which will enable the weaver to make a rug from a single strand or braid of material, and enable him to change the color of the rug to produce a finally completed article having alternate bands or rings of colors to produce a rug of pleasing appearance.

FAN OR BLOWER.—E. L. GARFIELD, c/o Monson Cooling System Co., 70 W. 45th St., New York, N. Y. The general object of the invention is to provide a fan or blower with a view to promote facility in making and assembling of the structural elements entering into the fan and its frame as well as to promote convenience in the installation of the fan in a ventilating system, and to provide a fan which is durable and made up of simple parts.

SUBMARINE MINE.—T. J. CAHILL, 238 N. 12th St., Philadelphia, Pa. This invention relates to submarine contact mines. The object is to provide for the preliminary handling of a submarine mine up to the time when the mine is submerged, and it is intended to provide against premature explosions during the operation of handling and transporting the mine, by covering the automatic igniting devices with a rigid metal protection.

PICTURE FRAME.—I. STARR, 2073 Mapes Ave., Bronx, New York, N. Y. An object of this invention is to provide a frame which includes a pair of transparent faces adapted to expose both sides of a sheet located between them. A further object is to provide a frame having a hinged or detachable member at one side which may be removed to permit the entrance or withdrawal of a picture.

MOISTURE-PREVENTING COMPOSITION.—W. H. BRABANT, 727 N. 9th St., Sheboygan, Wis. The invention particularly relates to a composition for the treatment of locomotive cab windows, wind shields and the like which are subjected to the elements; the aim is to provide a composition whereby rain and other moisture is caused to flow in a thin even sheet in such manner as not to obstruct a clear vision. The composition consists of tobacco water combined with sugar and paraffin; it may be readily applied to the surface to be treated.

COMB.—J. P. CANEAVRI, 509 4th St., Port Arthur, Texas. The object of this invention is to provide a comb especially adapted to be utilized to effect the straightening of extremely kinky hair whereby the hair after undergoing treatment of the comb is straightened and is rendered of such quality that it may be dressed and fixed as desired.

MAP.—C. E. ANDERSON, 1314 Race St., Philadelphia, Pa. The invention more particularly relates to an intensified map especially adapted for educational purposes. The object is to provide a map which illustrates the topographic and geographic features of the subject of the map, which in the instance of the United States illustrates clearly the boundaries of the States and of the counties thereof, and affords means by which the proportionate size of the States and counties and other countries of the world may be illustrated.

BOX BED SPRING CONSTRUCTION.—B. LEVINE, 205 Covert St., Brooklyn, N. Y. An object of the invention is to provide a simple, compact box spring frame which is insect proof. An object is to provide a frame having a cover fabric, or other suitable material the ends of which are turned over the edges of the bottom of the frame and clamped between the edges and a closure portion.

COMBINED MATCH AND TOOTHPICK.—M. BERCOVICI, Calea Nationala 213, Botosani, Romania. The invention relates to an arrangement for carrying matches and toothpicks in a wrapper such as are used for pocket matches; the arrangement comprises two overlying and connecting portions, each portion having a plurality of separable members, both ends of which are free, one end being pointed and the other provided with an igniting substance.

CAMERA ATTACHMENT.—W. C. MASON, 419 W. 115th St., New York, N. Y. The invention has for its object to provide an attachment by means of which the camera may be focused in the ordinary way, and the operator may be included in the picture, an arrangement of clock work setting off the shutter exposing the film or plate at a predetermined number of seconds. The attachment may be adapted to a number of different makes of cameras.

SHIPPING TAG ENVELOPE.—C. P. KLEEBAUER, c/o Cohoes Envelop Co., Cohoes, N. Y. Among the objects which the invention has in view are to provide means for reinforcing the portion of an envelop to which is attached the devices whereby the envelop is secured to the article shipped, to facilitate the introduction of the tying device, and to simplify the general construction.

CLASP ENVELOP.—C. P. KLEEBAUER, c/o Cohoes Envelop Co., Cohoes, N. Y. This invention has for its object to provide an attachment for locking the closure flap of an envelop constructed from material similar to the body thereof, and arranged to increase the resistance to any releasing movement in proportion as the movement is increased.

RUDDER LOCK.—F. H. ROGERS, 386 Chestnut St., Arlington, N. J. The object of the invention is to provide a rudder lock, more particularly for use on ferry boats, which may be operated at a point remote from the rudder post so that it may be operated if the deck of the vessel is occupied by vehicles. A further object is the construction of a device

(Continued on page 174)

The Motor Clipper

(*Continued from page 171*)

model is experiencing the minimum resistance obtainable.

We now come to the sails of the "Motor Clipper." In the otherwise excellent picture in the April 23rd issue, the artist has made a striking mistake in leaving the upper gaffs standing, whereas in practice these gaffs are always lowered, the throat standing, and with the sail secured to the after side of the masts. Thus nothing is left dangling above the lower gaffs, and these are kept steady by the wind pressure. Otherwise the shortening of the sails is correctly shown in the picture; with only the lower courses, as shown here, the vessel is fit for almost anything in the way of gales at sea.

The spars of the lower sails are used as cargo booms as shown in the illustration, being set off on derrick table and cross trees to give more "swing" to the cargo, specially in five- and six-masted schooners with short spars. The lower sails are stowed, and thus there is no obstruction to working the cargo, and the costly lower sails are saved.

The sails on each mast are identical; which means the smallest number and cost of reserve sails and spars. When one reads of a big new five-mast barque receiving a complete double suit of sails from the builders (82 sails in all), one might stare indeed at such waste in the present economic crisis. Certainly cheap ocean carriage is not fostered by such extravagance. Let us not forget that cheap freight rates concern not only the shipowners, but industry and farming and all civilization.

In view of the overwhelming evidence in favor of the *efficient* sailing ship, it is indeed funny to hear the reasons urged by some steam shipowners against the sailing ship. They are the very reasons that, in 1865, were used *against* the steamer, and *for* the sailing vessel. Conservatism always finds a seemingly plausible reason for keeping in the old rut; but necessity is a hard master. The shipowner who survives in 1930 will own and operate only vessels that, on the smallest possible capital outlay (first cost, interest, depreciation, etc.), involve the smallest operating expenses and can carry cargo for the cheapest freight rates, independently of coal strikes, fuel shortage, wind and weather.

Such a vessel, I believe, is the "Motor Clipper" of 5000 tons D.W., big enough for profitable working, small enough to get cargo anywhere.

Transmitting Photographs and Drawings by Radio

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mechanical, electrical and other troubles must arise. The main difficulty is to reduce the lag as much as possible, so that one impulse will not be piled atop the preceding one.

Facsimile handwriting and printed matter have been transmitted by radio to the French receiving station. In fact, it is believed that the greatest application of M. Belin's remarkable system will perhaps be in the direction of greater accuracy, and the facsimile transmission of messages. Column after column of newspaper print or typewritten matter can be transmitted by wire or wireless, and received without a single deviation from the original. Furthermore, because of the high speed of this transmission, it will greatly increase the traffic over our present systems of communication.

Industrial Alcohol

(*Continued from page 164*)

In Switzerland, where cheap water power is available, it is said that successful plants have been erected for making alcohol from calcium carbide. The carbide is first made in the regular way in the electric furnace and is then converted into acetylene by means of the action of water. Alcohol may be produced from the acetylene in two or three ways by catalytic action.

In England alcohol has been successfully produced from ethylene obtained from coal and coke oven gases. The report of a committee to the British Parliament recently emphasized the importance of this step. This statement was made:

"The amount of ethylene in the gas works and coke ovens of Great Britain is estimated to be sufficient to yield annually up to 150,000,000 gallons of 90 per cent alcohol, which the *Times* declared the makers could afford to sell for 15.3d (30 cents) a gallon."

Another possibility which makes an appeal to popular fancy and which will no doubt be revived from time to time, is the use of small stills in which the farmer could utilize his waste products in making his own motor fuel. In fact this practise is not at all uncommon in Germany. But according to B. R. Tunison, a trade authority, there is little hope that this source will ever effect the market in this country.

"There are several reasons," says Mr. Tunison, "why this is not likely to take place. Labor is very much higher in this country than in Germany. The farmers of this country have become accustomed to production on an extensive scale rather than in an intensive manner, and are not likely to be satisfied with the results of a small distillery. In order to obtain satisfactory results the fermentation must be carefully controlled and the average farmer does not possess sufficient technical training to do this effectively. The manipulation of the alcohol plant is difficult except to the technical man. These farm plants would necessarily be small units because of the limited amount of raw material available, the cost of the installation would be high, the labor cost would be excessive, the output would be small, and the unit cost of production would be so high that the farmer could buy alcohol cheaper than he could make it. Our case is quite different from that of Germany where these conditions do not exist and where the industry has been subsidized by the government. Without such subsidy and the government pressure, it is my opinion that the farmers of this country are not likely to produce alcohol for commercial purposes for some time."

There is one other possibility for cheap alcohol which deserves more than passing attention at this time. This is the chance that we will find in the tropics some plant or plants rich in starch or sugars, which could be used for making alcohol, but which is not used as a food.

The nipa palm, for instance, may serve as a source for industrial alcohol. It is said there are over 100,000 acres of nipa swamp in the Philippines, of which about 90 per cent has never been touched and it is estimated that this untouched swamp area could be made to yield 50 million gallons of alcohol every season. Various specimens of the agave and cactus are used in Mexico and the southwestern part of the United States in making alcoholic drinks and it is considered possible that some day these plants may be an important source of industrial alcohol. There are many other tropical plants which may be used, but the expense of transporting them to existing alcohol plants, the difficulties of establishing new plants in the tropics and the great distance from the markets all argue against any revolutionary development in this direction.

It will thus be seen that the situation is a very complex one and that the problem of cheap alcohol is being attacked by many minds from many angles. The materials which can be used for the commercial production of alcohol already are a formidable list and to these are constantly being added others.

(*Continued on page 175*)

RECENTLY PATENTED INVENTIONS

(*Continued from page 172*)

which shall be incapable of becoming loosened during the progress of the vessel.

LEDGER TRAY.—J. E. BEMIS, c/o Rude Auto Co., Marshalltown, Iowa. Among the objects of this invention is to provide a device for holding data cards or the like which is extensible longitudinally and laterally, whereby varying numbers of cards may be accommodated and selected cards may be partly withdrawn laterally for reference without removing the same from the order in which they are placed.

SPIRAL GUIDE FIRE ESCAPE.—A. W. BUTTERFIELD, 7512 58th St., S.E., Portland, Ore. An object of the invention is to provide a portable fire escape comprising a cable adapted to be securely anchored to a window casement sash or the like and a hand grip adapted to receive the cable in such a manner that the rate of movement is retarded, moving slowly downward when a load is suspended therefrom. The device is small and light and may be carried in a traveling bag or the like.

DISPENSING CAN.—F. J. LACINA, address A. Dudek, c/o Farmers State Bank, Clarkson, Neb. This invention has for its object to provide a can which may be held in any position convenient to the user and yet dispense its contents without difficulty. A further object is to provide means whereby oil will be prevented from flowing from the can when it is unintentionally inverted; means are also provided whereby oil may be drawn from the can until it is practically empty.

FUEL IGNITER.—C. J. VLASAK, 3340 S. Compton Ave., St. Louis, Mo. The invention relates more particularly to devices for igniting fuel in stoves, furnaces, grates, and the like without the necessity of kindling or paper, the prime object being the provision of an inexpensive and readily adjustable device of this nature adaptable to convenient support and capable of easy manipulation.

BOW FACING OAR.—J. L. KEMP, 266 S. Meeting St., Charleston, S. C. The primary object of the invention is to provide an adjustably mounted oar which may be operated from a sitting or standing position in a row boat or similar craft. The device may be moved to any position along the side of a boat and is provided with means for operating the oar while facing the direction of travel, also means to regulate the forward or backward sweep.

AUTOMATIC FLUSH.—J. B. WARES, 4506 S. 32nd St., Omaha, Neb. The invention relates to flushing devices particularly for use in connection with toilets of any kind, and has for its object to provide a flush which is so constructed that the reservoir tank will be emptied at predetermined intervals whereby the toilets may be kept in a thoroughly sanitary condition.

HUMIDIFIER.—L. G. HOLTSCHNEIDER, 15 Maple Terrace, Charleston, W. Va. Among the objects of this invention is to provide a device which will occupy the space of a cigar in a box of cigars and which can be adjusted to give just the desired moisture or to shut it off entirely. A further object is to provide a humidifier which has an inner absorbent core spaced from the walls of the casing so as to permit of a relatively large evaporating area around the core.

HAT STRETCHER AND SHAPER.—D. FREEDLINE, 1250 Fulton St., Brooklyn, N. Y. The special object is to provide a hat stretcher and shaper designed to permit the salesman in a retail store to readily shape a hat so as to accurately fit the customer's head, and to accommodate bumps or other irregularities of the head. Another object is to permit of readily ironing or steaming the base portion of the hat crown.

TRANSPLANTING RECEPTACLE. — L. WEIL, Goldsboro, N. C. This device relates to the transplanting of large evergreens, shrubs, and more particularly trees with the roots and earth or "ball" as it is termed, around them. This transporting and transplanting receptacle includes a pair of side walls which are lowered into the ground around the root ball and hingedly secured together; means are provided with the walls, adjacent their lower edges for supporting the earth within the receptacle thus preventing to a greater extent jars loosening the earth around the roots.

UMBRELLA HANDLE.—R. KAMENETZKY, 32 Union Sq., New York, N. Y. An object of the invention is to provide an umbrella which is hollow and contains a pair of cords so that the hand may be slipped between the cords and the handle suspended therefrom, or the cords may be placed in the handle out of sight when it is not desirable to use them. Another object is to provide a coin purse on the knob which holds the cords.

IRONING BOARD.—A. MINTS, 260 Delancy St., New York, N. Y. The primary object of the invention is to provide an ironing board support so constructed as to permit use of the board with garments of all types, at the same time provide ample room beneath the board to receive that portion of the clothes not operated upon. A further object is to provide a board which may be turned end for end and which will be locked against movement.

ROOF DOOR.—P. HOGSTROM, 952 10th Ave., Long Island City, N. Y. An object of this invention is to provide a roof door that will automatically open under a predetermined heat. A further object is to utilize the weight of the door and cause it to gravitationally swing to the open position and to normally restrain the door in closed position subject to a fusible element, also to provide for manual raising and lowering the door without affecting the automatic control.

COTTER PIN.—H. R. FRANCIS, 218 E. 5th St., Los Angeles, Cal. This invention relates to a cotter pin composed of two independent separable interlocking members. An object is to provide a cotter pin in which the two members are precisely alike but are reversely positioned, and insure a perfect lock holding the part together against vibration, at the same time being readily assembled or taken apart without tools.

Hardware and Tools

COMPOSING STICK.—C. B. WRIGHT, 2787 Boulevard, Jersey City, N. J. An object of the invention is to provide a composing stick arranged to enable the compositor to correctly set the type in case a stereotype or other insert is to be used in conjunction with the said type and without requiring such stereotype for the insert on the stick; the user may open the filled stick for removal of set-up type or any part thereof.

BORING AND THREADING TOOL.—D. D. WELLS, Genl. Delivery, Wynona, Okla. Among the objects of the invention are to provide an internal spring boring and threading tool which when used for instance in cutting screw threads or in finishing smooth bores, will enable a smooth and even surface to be produced with the minimum of skill on the part of the operator; also to provide a tool that will enable heavy or rough cuts to be taken without danger of the tool breaking.

MASSAGE TOOL.—H. MALM, 207 5th Ave., New York, N. Y. This invention relates to toilet devices, and more particularly to devices designed for massaging the face and scalp. It is the primary object to provide a combination device which is capable of attachment to the hand of the operator in such manner that either device may be used.

TOOL HOLDER.—B. T. CARSON, c/o Kinderhook Knitting Co., Kinderhook, N. Y. The principal object of the invention is to simplify the means for associating a tool with a tool-supporting shank which means is adjustable and eliminates the use of fastening devices such as screws or bolts; the device when adjusted will rigidly clamp the tool in such manner that it will not become disarranged from its set position.

MULTIPLE SUCKER ROD SOCKET.—A. H. NEILSON, 417 E. 1st St., Tulsa, Okla. Among the objects is to provide a socket having grippers or slips with the teeth on the inside disposed on a continuous taper from the entrance to the upper end, so as to grip any size of object within the compass of the socket, regardless of whether that object is the round, square or irregularly shaped part of a sucker rod or the like.

FOLDABLE HACKSAW.—L. D. BARNER, Kountze, Texas. A purpose of the invention is to provide a folding hacksaw which in its extended position functions as effectively as a saw of rigid construction, at the same time being foldable to occupy the minimum amount of space so that it may be carried in the pocket.

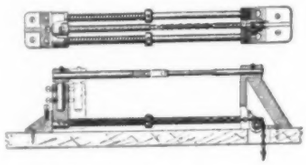
WEDGE.—A. T. JESPERSEN, 5116 Walnut St., Omaha, Neb. This wedge is more particularly adapted for the splitting of logs, a purpose being to provide a wedge of this character which is of simple and efficient construction and which is capable of effecting a greater degree of splitting than wedges of general use. The wedge comprises a main section and an auxiliary section.

PIPE WRENCH.—A. W. KIEFER, 1909 N. Keystone Ave., Chicago, Ill. An object of the invention is to provide means for permitting a yielding movement of one of the jaws of the wrench relative to the other jaw to more positively grip a circular body, such as a pipe, between the jaws. A further object is to provide a device that can be instantly adjusted to work of varying sizes.

Machines and Mechanical Devices

WASHING MACHINE.—C. E. BEARDSLEY, 417 W. Allen St., Rice Lake, Wis. The invention relates to a washing machine in which the clothes will be rubbed upon and by surfaces corresponding to that of a washing board, and which will adapt itself within certain specified limits to any given mass of clothes, and produce a satisfactory cleansing action irrespective as to the small or large amount of clothes deposited for washing.

TURNOVER MACHINE.—L. GOLDSTEIN, 179 Herzl St., Brooklyn, N. Y. The object of the invention is to provide a turnover machine more especially designed for turning over tubular articles notably fur pieces such fur



A PLAN VIEW AND SIDE ELEVATION

paws and the like without danger of injuring the article during the turing operation and without requiring the use of a skilled operator. The machine is simple, durable and not liable to get out of order.

BOOK INDEXING MACHINE.—W. FABKAS and C. GREBENSTEIN, 133 Lincoln St., Astoria, L. I., N. Y. Among the objects of the invention is to provide a book indexing machine arranged to permit of quickly and accurately cutting indexing notches into the leaves of a book. Another object is to enable the operator to cut the desired number of notches in a comparatively short time without undue physical exertion.

POWER TRANSMITTING MECHANISM.—W. E. ROBB, Box 268, Oil City, Pa. The invention has particular reference to an eccentric transmission device. An object is to provide an eccentric power-transmission element in which the friction generated is reduced to a minimum. Another object is to produce an element which is compact and composed of a minimum number of parts. A further object is to provide an efficient lubricating means.

FLUID MEASURING MACHINE.—S. F. MIOTON, Medical Bldg., New Orleans, La. The invention has for its object to provide a measuring machine which will accurately measure fluids, the construction being such that when the machine has been once actuated the measuring process must be fully completed before the machine may be actuated a second time. Another object is to produce a machine with means by which different quantities may be measured.

LAWN MOWER.—H. L. RICHENDIFER, Box 33, Bladen, Neb. An object of the invention is to provide a lawn mower which will cut grass in awkward places not conveniently reached by the ordinary type of mower, and which will also cut weeds or other upstanding growth and not mash the same down as is the case with lawn mowers in ordinary use. This machine is strong, can be easily operated, assembled, and taken apart for cleaning and repairing.

INDEPENDENT FEED RAIL DRILL.—W. F. MCCARTY, c/o Defiance Machine Works, Defiance, Ohio. The invention relates to metal working machines of the heavy service type; its object is to provide an independent rail drill more especially designed for use in locomotive and railway shops, gas engine and automobile factories, general machine shops and similar establishments, and arranged to permit of heavy gang drilling or heavy jig drilling. The machine is so compact that a single operator can keep a number of drill spindles, either single or in group, in operation.

MULTIPLE SPINDLE DRILLING MACHINE.—W. F. MCCARTY, c/o Defiance Machine Works, Defiance, Ohio. An object of the invention is to provide a multiple spindle drilling machine of inclosed unit construction and designed for simultaneously carrying on a number of drilling operations. Another object is to provide an automatic quick advance, slow work feed and a quick return of the drill spindles, thus insuring a high speed production without requiring attention on the part of the operator, except to place the work in position, start the machine, and remove the finished work.

MACHINE FOR MAKING MOLDS.—C. B. WORTH, 2443 W. Harrison St., Chicago, Ill. Among the objects of the invention is to provide a machine for making molds for castings having means for throwing mold forming material at high velocity directly into a flask. Another object is to provide a device that has means for varying the speed of operation of the sand throwing or projecting means, whereby the sand is packed with greater or less density as desired.

SHOVELING MACHINE. — S. J. KRULY, 2926 7th Ave., Miami, Arizona. This invention has for its object to provide mechanism for shoveling ore, dirt and the like, wherein a supporting platform is provided, having an inclined track on which the shovel runs, the car carrying a ram for loading the shovel, and power operated means for raising the shovel, the platform being mounted on a car and adjustable, with respect to the car.

LUMBER HANDLING MACHINE. — J. R. SZYMANSKE, 216 N. 10th St., Yakima, Wash. An object of the invention is to provide a machine adapted more particularly to handling railroad ties. A further object is to provide a mechanically operated device, the receiving end of which is positioned adjacent to a quantity of railroad ties while the other end is positioned at a place to which it is desired to transfer the ties, the ties being first manually placed on the receiving end from whence they are taken up without further attention by the operator.

REPRODUCER FOR TALKING MACHINES.—J. W. KAUFMANN, 1730 N. Monroe St., Baltimore, Md. This invention has for its object to provide a connection between the needle and the diaphragm controlling lever for transmitting in as perfect a manner as possible the movement of the needle, to provide for a softening of the tone and elimination of mechanical elements therefrom, as well as for increasing the volume of tone.

ROAD BUILDING MACHINE.—J. W. HALTZEL, Warren, Ohio. This invention has for its object to provide a machine especially adapted for tamping brick and newly laid concrete, where a tamping member is provided of relatively large extent adapted to rest upon the surface of the pavement, and a ram contacting with such first named member to thoroughly tamp the brick or concrete, and cause the same to have a smooth surface.

PRESS BED MOVEMENT.—J. W. WEAVER, Box 371, Raleigh, N. C. The invention has reference to bed movement mechanism of one and two revolution cylinder printing presses, and other machinery requiring horizontal reverse action of uniform speed, precision and accuracy. An object is to provide stationary bearings of the driving pinion wheel with continuous mesh of said pinion wheel and gear teeth in a continuous alternating rack.

JACQUARD MECHANISM.—G. C. L. TISCH, 454 Spring St., Elizabeth, N. J. An object of the invention is to provide a drive adapted to be connected to any form of jacquard link wherein the power is transmitted through a form of mutilated worm which will act as driving means for links, also as means for rigidly holding the links in a certain position while the thread-carrying bars are being shifted. Another object is to provide a drive wherein the parts may be easily adjusted for receiving different sized driving members.

MECHANICALLY-OPERATED ADVERTISING DEVICE.—A. ASTON, 191 Broadway, New York, N. Y. The primary object of the invention is to provide means for demonstrating the action of what is known as a lever-type, self-filling fountain pen. The apparatus comprises a model of a pen or other article having a lever adapted to be given a swinging movement, means for raising and lowering the model, and for angularly displacing the lever.

PRINTING PRESS ATTACHMENT.—J. H. CUNNINGHAM, 534 Jackson St., San Francisco, Cal. An object of the invention is to provide means for quickly drying printed sheets as they are delivered from the press. A further object is to provide for introducing a current of heated air to the sheets to dry the ink, and to utilize the air pump which is ordinarily employed to operate the feeder for furnishing the current of air required.

PULSATOR FOR MILKING MACHINE.—A. D. ELLINGTON, Lock Box 491, Springfield, Ill. Among the objects of the invention is to provide a pulsator in which means is provided for alternately transmitting to teat cups or other parts of the machine pressure and vacuum impulses whereby squeezing and sucking actions are alternately produced. A further object is to provide a device in which

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Industrial Alcohol

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Already the U. S. Industrial Alcohol Company has erected a large plant for the specific purpose of making a motor fuel with an alcohol base on a large scale and it is operating on part capacity. As soon as economic conditions permit the plant will be put in full operation. The first motor fuels of this type will have other ingredients to give the mixture the characteristic properties of gasoline. But as gasoline is gradually replaced, it is reasonable to believe that better combinations will come into use and that the designers of internal combustion motors will alter their designs to get maximum economy from the fuel. And this happy day for the motorist, there is every reason to believe, is not many years away.

Cultivated Rubber

(*Continued from page 166*)

and in tapping the knife cut is made across these cells causing the latex, or milky white sap, to exude. Lying just beneath the cortex is the cambium whose function it is to produce both latex cells and wood cells. Hence in tapping great care must be taken not to injure the cambium else the tree is seriously hurt.

When the tree is ready for tapping, the inspector passes it and guide lines are placed which are to be followed in the cutting. Of the many methods of tapping the oldest is the V method, while the most popular method in recent years is known as the herring-bone method.

In tapping, the incision is made entirely through the outer bark to the cortex and almost up to the cambium and a thin shaving removed.

Immediately the tree starts to bleed—the latex, a thin milky fluid, commences to trickle down the trunk of the tree. A glass or porcelain cup has been placed at the bottom to receive this. After a few hours the flow gradually decreases and finally it coagulates and a clot is formed. Then the tapper strips off the clot and makes a further incision.

Each tree will yield approximately three-fourths of an ordinary cupful of latex per day; and the tapping is done in the early morning in order to obviate the coagulating effect of the tropical sun.

At five o'clock in the morning the tappers gather in front of the manager's house, roll is called, and the natives start on their rounds. Each coolie takes a basket, into which he puts the strippings of latex or clots of the previous day's cut. By nine o'clock he has completed his first round, also done the tapping. He then starts his second round on which he collects the latex from the cups placed under the incisions.

The latex collected is taken to the factory and poured through a cloth strainer into a large "settling" tank, while the bark shavings are dumped into the "soaking" tank. The fine particles of bark that may have fallen into the cups during the draining process are removed by means of a sieve—so too with any latex which may have formed into lumps. The strained fluid is allowed to settle, after which the top is skimmed, freeing the surface from any bubbles and small clots.

And the coolies' work for that day has ended at noon.

After the latex is strained and skimmed it is ready for the coagulating process. This is accomplished by the addition of acetic acid. The fluid is then stirred with wooden paddles and allowed to stand over night. In the morning rubber is found floating on the top of the tank; it is a tough elastic mass of whitish color.

This mass of rubber is cut into lumps weighing from ten to fifteen pounds, and these are run through washing machines and come out in long sheets which are placed over wooden bars to dry. These sheets are known as crepe, and in the drying process the color is changed from white to a beautiful yellow. Some of these rubber sheets are smoked, changing the color to dark brown. These crepe sheets are then packed ready for shipment, and start on their 10,000-mile journey to the manufacturer of tires—and one of the greatest achievements of mankind is completed—only to start another industrial romance.

The Heavens in September, 1921

(*Continued from page 168*)

in the southeast. Aquarius and Capricornus have no bright stars, but Grus, which barely rises above our horizon, is a conspicuous constellation for observers further south. The eastern sky is a little better, with Taurus rising, Aries above, and the great square of Pegasus still higher.

The Planets

Mercury is an evening star all through September. He is hardly visible, however, until the latter part of the month, but at its end he sets at 7:30 P. M. and should be easy to see in the twilight. Venus is still a morning star, rising at 2:30 A. M. at the beginning of the month, and at 3:20 at its close. She is by far the brightest thing in the sky and cannot be mistaken. Mars too is a morning star, rising at 3:40 A. M. in the middle of the month. He is moving eastward in the sky, but not as fast as Venus, so that she gradually overtakes him, and by the end of the month they are close together.

Jupiter and Saturn are evening stars until the 21st and 22nd, when they come into conjunction with the sun within a day and a half of one another, Saturn being the first. On the morning of the 14th these two great planets are in conjunction and only a degree apart. A conjunction of these two planets is rather an unusual affair, occurring only at intervals of twenty years—Jupiter completing 1⅔ revolutions about the sun, and Saturn ⅔ of a revolution, in this interval. This time, unfortunately, the two planets are only six degrees from the sun, and there is no hope of seeing them, though they will be pretty close together when we lose sight of them early in the month.

Uranus is well placed for observation, being in 22h. 38m. 9s. R.A. and 9° 29′ 37″ south declination on the 3rd, and in 22h. 34 m. 14s. R.A. and 9° 52′ 38″ south on October 1st. This puts him from 2½ to 3½ degrees west, and a little less than two degrees south, of the fourth magnitude star Lambda Aquarii. He is observable until long after midnight. Neptune is a morning star in Cancer and rises about 2 A. M., so that he can just conveniently be observed before dawn by anyone who has occasion.

The moon is new at 11 P. M. on the 1st, in her first quarter at 10 P. M. on the 8th, full at 2 A. M. on the 17th, in her last quarter at 4 P. M. on the 24th, and new again at 7 A. M. on October 1st. She is nearest the earth on the 29th and farthest away on the 13th. During the month she is in conjunction with Mercury on the 2nd, Jupiter and Saturn on the 3rd, Uranus on the 15th, Neptune on the 27th, Venus and Mars on the 29th, and Jupiter and Saturn again on the 30th.

At the new moon which comes just as the month ends there occurs a total eclipse of the sun. As in many other eclipses when the moon is some distance from its node, the shadow track lies entirely in the polar regions. Beginning in the south Pacific, it just misses Cape Horn, turns southward, and crosses the Antarctic continent to a point close to the south pole. It is doubtful whether the total phase will be seen by anyone except perhaps a few sailors. As a partial eclipse it will be visible throughout all South America below latitude 14° south.

Finally, it may be noted that at 9:20 A. M. on September 23rd, the sun crosses the celestial equator and enters the "sign"—though not the constellation—of Lyra. According to almanac reckoning, at this time autumn commences.

En route, C.P.R.R. west of Winnipeg, August 19, 1921.

RECENTLY PATENTED INVENTIONS

(*Continued from page 174*)

means is provided for regulating independently of each other the pressure and vacuum impulses.

DISH WASHING MACHINE.—H. B. OVES, 10 S. Main St., Wellsville, N. Y. This invention has for its object to provide a machine of the character specified capable of attachment to an ordinary water faucet, and having a circular brush adapted to be rotated by the flowing water, and carrying a soap chamber which is rotated by the flowing water to deliver the detergent to the brush.

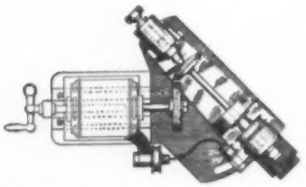
REPRODUCER FOR TALKING MACHINES.—J. W. KAUFMANN, 1730 N. Monroe St., Baltimore, Md. The object of this invention is to provide a connection between the needle and the diaphragm controlling lever for improving the tone, making the reproduction more faithful and distinct and eliminating the disagreeable machine elements of the tone.

Musical Devices

VIOLIN.—D. H. NEILLY, 15 E. Wash St., Bradford, Pa. It is the purpose of this invention to provide a violin so constructed as to produce sound vibrations in great volume and to secure a more perfect blending of sounds than is possible in violins as heretofore constructed. The body of the violin is formed of two separate and distinct sections arranged side by side and a string supporting bridge connecting the sections together.

Prime Movers and Their Accessories

GRINDING MACHINE.—J. O. ROLLINS, Route 2, Box 681, San Gabriel, Cal. This invention relates more particularly to a machine for grinding the beveled surface on the disk-shaped heads of puppet valves used on



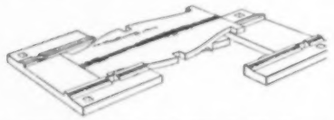
A PLAN VIEW OF THE MACHINE IN ACTION

internal combustion engines. The primary object is to provide a self-contained, so to speak, valve-grinding outfit which will enable any one regardless of their mechanical skill to effect a proper grinding or cleaning of valves or the like.

Railways and Their Accessories

LOCOMOTIVE DRIVER.—J. F. MCCARROLL, Holden, La. This invention particularly relates to locomotive drivers of the gear type. The object is to provide a driver for any gear ratio, which is of such simple and compact construction that it resembles and partakes of all the advantages of the directly connected driver, and which is possessed of a high degree of durability, is reliable in operation and easy and inexpensive to manufacture and apply.

RAIL CONNECTING AND SUPPORTING MEANS.—J. H. JENNINGS, Georgetown, Conn. This invention contemplates an effective means of connecting and supporting the meeting ends of a pair of rails with a view to minimizing the jar incident to the passage of the wheels



A PERSPECTIVE VIEW SHOWING CHAIR MEMBERS AND BRIDGE PLATE REMOVED

over the rail ends. A further object is the provision of means for the meeting ends of the rails which prevents creeping with respect to the ties. The device may be readily applied, and will eliminate the necessity of altering in any manner the construction of standard rails.

RAILWAY TIE AND RAIL FASTENER.—C. E. ESTABROOK, Springport, Ind. A purpose of the invention is the provision of a tie or rail fastener so constructed as to be accommodated to different kinds of ballast, rails, rolling stock and climatic conditions; the device is simple, durable, efficient and capable of being adjusted to support the rails of tracks of different gages.

TRACK SUPPORTING AND FASTENING MEANS.—W. O. BATTS, Wilmot, Kan. The general object of the invention is to provide a permanent track bed as well as track fastening means, and means to buttress the track against spreading strains. More specifically the invention has for an object to construct a permanent road of concrete doing away with wood cross ties. The construction is such that it will insure a properly drained road bed, requiring little labor in its upkeep, and will produce an even strength over the entire road.

RAILWAY CROSSING.—R. E. BOWEN, 1340 W. 24th St., Los Angeles, Cal. This invention more particularly relates to a railway crossing in which provision is made for so forming the crossing tracks and wheel-flange grooves as to eliminate the bumping or pounding caused by the car wheels jumping across the grooves formed in the respective tracks.

SWITCH LOCK.—J. M. MORRISON, 76 Oak St., Plattsburg, N. Y. The object of the invention is to construct a lock which is incapable of being tampered with, and in which it will be impossible to effect a withdrawal of the key operating such lock until the switch has been completely thrown and locked in position. A further object is to construct a device which should cause the actuation of a semaphore to indicate the condition of the switch should the same be other than completely thrown.

Pertaining to Recreation

GAME APPARATUS.—R. A. G. MCCOY, 142 W. 28th St., New York, N. Y. The invention relates to a game apparatus available for a large number of players, the apparatus involving an indicator and an annular series of designated areas relatively to which the indicator revolves so that the point of stoppage of said indicator determines the particular player to receive a count.

AMUSEMENT DEVICE. — W. C. HADLEY, 3 E. 43rd St., New York, N. Y. The object of the invention is to provide a device arranged to be supported upon the white keys of an automatic piano and having upon one of its surfaces the representation of a head of an animal or person from the upper jaw to the top, the upper jaw being located coincident with the lower marginal edge of the device and of a width corresponding to that of a white key so that when displaced on the white key the rise and fall will simulate the opening and closing of the mouth of the figure.

TOY CAR.—A. C. BROWN and S. P. SMITH, 25 Town St., Norwich, Conn. The invention relates to a toy car in which the car body is so mounted on supporting wheels as to not readily tip over when in use. An object is to provide a toy car having a suspension for the body which will not interfere with the turning of the front wheels, and will allow either front wheel or rear wheel to be raised from the ground without upsetting the device.

PUZZLE.—R. K. MILLARD, 303 Halket St., Pittsburgh, Pa. The general object of this invention is to provide a sectional puzzle made up of a definite number of sections of given shape, whereby the given task of solving the puzzle may be varied within limits to add to the interest of the puzzle.

RACKET.—G. AGUTTER, 57 Burns St., Forest Hills, L. I., N. Y. The invention has for its object to provide a tennis racket wherein means are presented which will materially strengthen the racket without adding weight thereto. Another object is to provide a racket having a metalic reinforcing lining for the wood head of the racket arranged in such a manner that the metalic reinforcement will overlap part of the head and will interlock with the handle.

AMUSEMENT DEVICE.—C. F. GEBERT, 315 W. 58th St., New York, N. Y. An object of the invention is to provide a device in the nature of a wheel vehicle which is operated by means of a board fulcrumed between its ends and constituting in effect a seesaw adapted to receive riders at the respective ends and provide steering means under control of either or both of the operators so as to cause the device to perform amusing evolutions.

BASKET BALL GOAL INDICATOR.—R. JACKSON, Jr., 329 Phelan Bldg., San Francisco, Cal. Among the objects of the invention is to provide mechanism in the form of an indicator for basket ball goals, which is adapted to indicate the fact that a ball has passed into or through the basket, by the sounding of a ball, which is struck by a lever as the ball passes into the goal.

Pertaining to Vehicles

TIRE CHAIN.—R. J. KLEINECK, Oxford Junction, Iowa. This invention has for its object to provide a chain comprising a plurality of sections which may be used either collectively or singly so that a single section may be utilized in case of emergency to release a car from a mud hole, where it would be impossible to apply the ordinary chains without the use of a jack.

OUTSIDE BRAKE.—C. VANCOTT, c/o Scientific Engraving Co., 406 W. 31st St., New York, N. Y. More particularly the invention relates to an outside brake structure which can be applied to the brake drum of a well-known type of automobile which has heretofore been equipped with an inside brake structure to take the place of the inside brake structure, and by this change provide a brake which is readily accessible which is not liable to get out of repair but if it does can be easily attended to.

HEADLIGHT.—H. F. HAMMOND, 116 Main St., South Shaftsbury, Vt. Among the objects of this invention is to provide in the ordinary headlights an arrangement of partition having dull surfaces which operate to prevent direct glare, but give full road illumination. The dimming action is mainly applied to the rays which radiate in a straight line.

DIRIGIBLE HEADLIGHT.—W. M., O. B. and N. S. LAWRENCE, 2009 4th Ave., Birmingham, Ala. The invention has for its object to provide headlights especially connected with the steering mechanism of an automobile to constrain the rays of light to turn with the vehicle, and to provide a supporting mechanism for the reflectors independent of the supporting mechanism for the lamps for permitting the reflectors to be turned without affecting the lamps. The attachment may be applied to cars of different sizes.

BABY CARRIAGE ATTACHMENT FOR MOTOR VEHICLES.—A. R. PRICE, Oregon City, Oregon. Among the objects of the invention is to provide an attachment which may be connected with an automobile, and which will provide an easy riding seat or couch for an infant, so mounted that the shock and jar of travel will not be transmitted to the attachment, and wherein the attachment is detachable and collapsible.

AUTOMOBILE THEFT-PREVENTING DEVICE.—P. WELLIVER, Hereford, Texas. The object is to provide a device of this character which will prevent the operation of an automobile by an unauthorized person. The device works in combination with the engine of an automobile and may be easily operated by an authorized person acquainted with the combination.

TIRE VULCANIZING APPARATUS.—A. L. JACOBSON, 185 E. 93rd St., New York, N. Y. One of the objects of this invention is to provide an apparatus and a method of vulcanizing which will permit the tires to be properly treated without any portion of the mold or tire coming in direct contact with the moisture. A further object is to provide a device which will permit a number of tires to be simultaneously vulcanized.

RADATOR THERMOMETER.—G. P. PITKIN, Bergenfield, N. J. It is an object of the invention to provide a radiator thermometer construction for use in connection with automobiles and which can be read in the dark. A further object is to provide a luminous thermometer which is supported in and forms a part of the cap or closure for the radiator.

STAKE.—G. B. ROBERTSON, address Orville E. Cain, Cheshire House Block, Keene, N. H. The invention relates to stakes which serve to retain a load upon a vehicle. An object is to provide a stake which is adjustable within certain limits. A further object is to provide a stake which shall extend in such a manner as to firmly engage a load and prevent accidental displacement thereof from the body of the vehicle.

DEVICE FOR PROTECTING THE IGNITION SYSTEM OF AUTOMOBILES.—J. H. BLODGOOD, 2006 Elmwood Ave., Tampa, Fla. It is a purpose of the invention to provide protection for the ignition system against the destructive action of the elements without modifying the construction of the hood and cowl by preventing water from contacting with the conducting wires and thus preserving their insulation and eliminating short circuiting.

VALVE.—G. W. THOMPSON, Cheboygan, Mich. The object of the invention is to provide a valve for interposition in the fuel line and in the oil supply line of a motor vehicle for controlling the flow of the fuel from a supply tank to the carburetor, by the pressure in the oil line, and so arranged that when the pressure is reduced below a predetermined point the supply of fuel to the carburetor will be cut off.

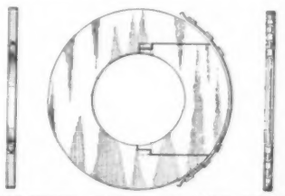
INLAID TREAD TIRE.—J. H. DWORK, 217 W. Kinney St., Newark, N. J. The foremost object of the invention is to provide a tire casing the arrangement of which is such that the danger of puncture is fully guarded against, at the same time preserving the necessary flexibility of the casing. A further object is to provide a tire casing, including means for preventing the displacement and lateral distortion of the tread.

BAND FOR FORD CARS.—J. MILLIGAN and C. R. LYTLE, Point Marion, Pa. This invention relates more particularly to clutch bands used in connection with automobiles for controlling the driving action or for checking the motion of the car, and to control the reverse and slow speed drives and the brake, the construction is designed to facilitate the replacement of new linings, and to permit such operations to be carried out without disassembling the transmission assembly and casing or housing.

ELEVATING COAL TRUCK.—A. KUKIELSKI, 19 Cook St., Jersey City, N. J. The general object of the invention is to provide a vehicle having a body adapted to be raised or lowered by parallel movement, and to provide an elevating body having an arrangement of discharge chutes adapted to discharge the coal either longitudinally of the vehicle or laterally together with means to control the flow of the coal.

SIGN.—J. P. FOX, address Donohue & Grugley, 1st Natl. Bank Bldg., St. Cloud, Minn. This invention relates more particularly to a sign carrier especially adapted for use with automobiles or similar vehicles. An object is to provide a device which may be releasably mounted upon the extra wheel or tire generally carried so as to display advertising matter by means of suitable characters carried by the sign.

HUB LINER.—J. W. WOLFENDEN, 3323 Park Ave., Nashville, Tenn. An object of this invention is to provide a device which may be located around the drive shaft of a locomotive truck between the driving box and hub of the



A TRANSVERSE SECTION AND SIDE ELEVATION

drive wheel to take up lateral wear of the parts. A further object is to provide a two-part disk or ring constituting a hub liner which may be readily attached or detached to a shaft or journal without removing any of the other parts of the machine.

WINDOW CLEANER.—S. YUASA, P. O. Box 48, Cupertino, Cal. The invention has reference more particularly to means for mechanically cleaning accumulations of snow, sleet, rain and the like from the surface of window shields or other windows so as to leave a clear vision through which the driver of the vehicle may clearly observe the road and traffic. The device may be manipulated from the driver's seat.

Designs

DESIGN FOR A FURNITURE COVER.—ELSIE M. THOMPSON, 58 W. 47th St., New York, N. Y.

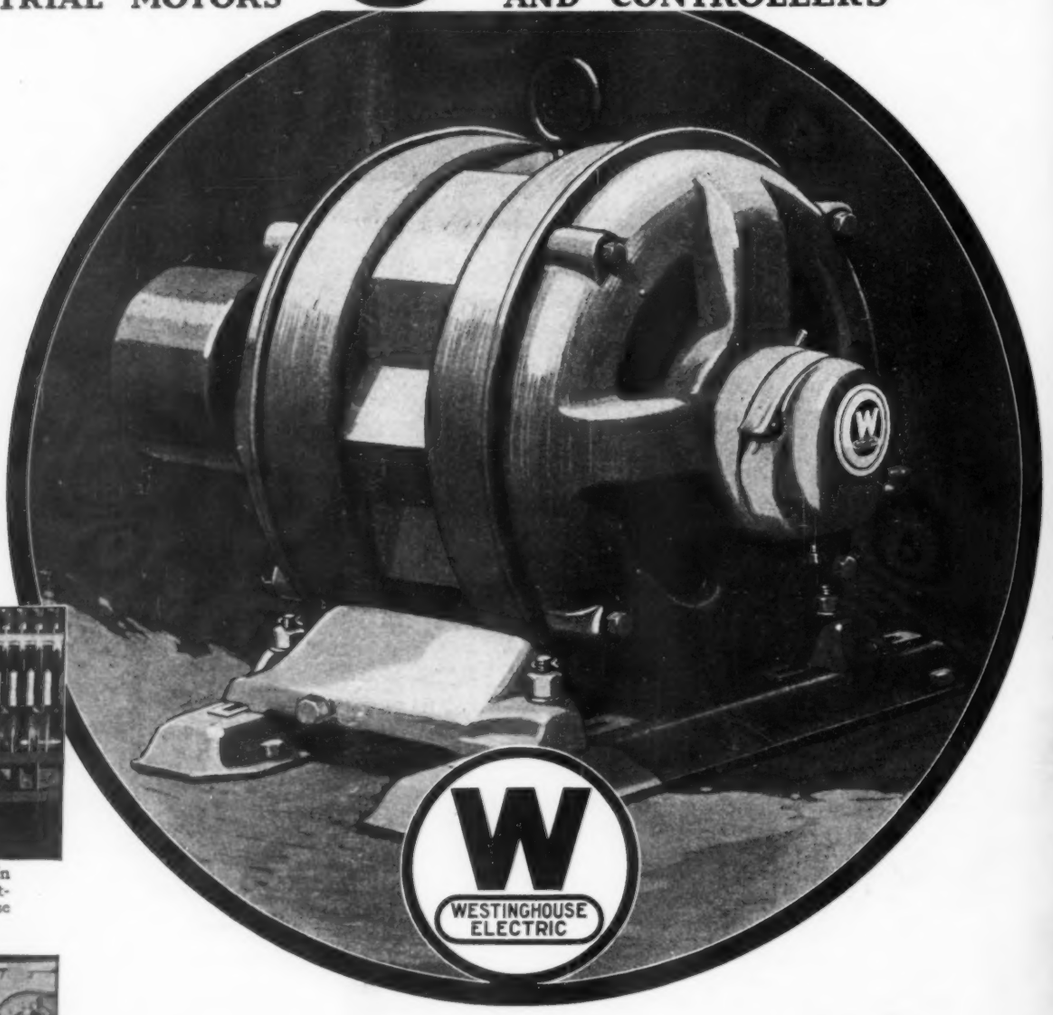
DESIGN FOR A PHONOGRAPH.—F. IUCULANO, 325 E. 12th St., New York, N. Y.

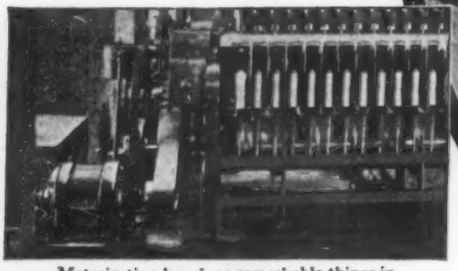
DESIGN FOR A TOY.—A. S. BUCHER, 320 McDonough St., Decatur, Ga. The invention has been granted patent on three designs representing a camel, an elephant and a goat.

DESIGN FOR A GOBLET OR SIMILAR ARTICLE.—S. MUNICH, 141 Roebling St., Brooklyn, N. Y.

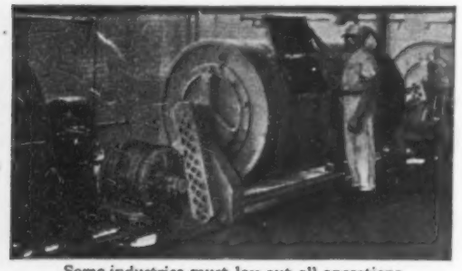
Westinghouse

INDUSTRIAL MOTORS AND CONTROLLERS





Motorization has done remarkable things in the textile and kindred industries. Westinghouse can supply many facts to those interested.



Some industries must lay out all operations with special regard to cleanliness. Westinghouse motors are specially adaptable in such cases.

Where a plant is crowded, where lighting is difficult, where the safety and convenience of the operator must be considered, Westinghouse motors always offer a solution.

Even One Motor Is Better Than None

Electrification of mammoth enterprises has been spectacular, but now is the time to consider the advantages of motors in commonplace installations. The facts are that motor methods sometimes offer greater possibilities of economy to the user of small powered apparatus than to anyone else.

The same advantages of economy and reliability that the motor brings to the user of large units, it brings also to the user of smaller sizes. Westinghouse engineering frequently shows the way to exceptionally large savings on small installations, because the older types of power transmission are often least efficient on small units. Westinghouse motors, designed to meet all classes of service, have been pioneers in many industries. These motors are made to exacting standards regardless of size and class of service.

Even one motor will materially reduce your power cost. Talk to the nearest Westinghouse office about it.

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